Thesis for doctoral degree (Ph.D.) 2020

Healthcare Financing Challenges and Opportunities to Achieving Universal Health Coverage in the Low- and Middle-Income Country Context

Sayem Ahmed

Karolinska Institutet

Thesis for doctoral degree (Ph.D.) in Health Economics
2020

Healthcare Financing Challenges and Opportunities to Achieving Universal Health Coverage in the Low- and Middle-Income Country Context

Sayem Ahmed

Karolinska Institutet

From Department of Learning, Informatics,
Management and Ethics (LIME)
Karolinska Institutet, Stockholm, Sweden

HEALTHCARE FINANCING CHALLENGES AND OPPORTUNITIES TO ACHIEVING UNIVERSAL HEALTH COVERAGE IN THE LOW- AND MIDDLE-INCOME COUNTRY CONTEXT

Sayem Ahmed

Karolinska Institutet

Stockholm 2020

Published by Karolinska Institutet.
Printed by Arkitektkopia AB, 2020
Cover illustration by Sayem Ahmed

ISBN 978-91-7831-711-0

Healthcare Financing Challenges and Opportunities to Achieving Universal Health Coverage in the Low- and Middle-Income Country Context

THESIS FOR DOCTORAL DEGREE (PH.D.) IN HEALTH ECONOMICS

By

Sayem Ahmed

Principal Supervisor:

Jahangir A.M. Khan, PhD
Researcher
Health Economics and Policy,
Department of Learning, Informatics, Management and Ethics
Karolinska Institutet, Stockholm, Sweden

Senior Lecturer in Health Economics
International Public Health,
Liverpool School of Tropical Medicine,
Liverpool, UK

Co-supervisor(s):

Clas Rehnberg, PhD
Professor in Health Economics
Health Economics and Policy,
Department of Learning, Informatics, Management and Ethics,
Karolinska Institutet, Stockholm, Sweden

Louis W. Niessen, PhD
Professor and Chair (Health Economics)
International Public Health,
Liverpool School of Tropical Medicine,
Liverpool, UK

Adjunct Professor,
International Health,
Johns Hopkins School of Public Health,
Baltimore, USA

Opponent:

Kamrul Islam, PhD
Senior Researcher
Uni Research Rokkan Centre,
Bergen, Norway

Researcher,
Department of Economics,
Bergen University,
Bergen, Norway

Examination Board:

Zarina Nahar Kabir, PhD
Senior researcher and Associate Professor in Public Health Care Sciences and Society, Department of Neurobiology, Karolinska Institutet, Stockholm, Sweden

Birger Forsberg, PhD
Associate Professor,
Health Systems and Policy Research,
Department of Public Health Sciences,
Karolinska Institutet, Stockholm, Sweden

Jesper Erik Sundewall, PhD
Associate Researcher
Social Medicine and Global Health,
Department of Clinical Sciences, Lund University, Lund, Sweden

Associate Professor
South Africa Social Medicine,
University of KwaZulu-Natal,
Durban, South Africa

I dedicate this thesis to my father, Jamil Ahmed,
who always wanted me to get a PhD.

ABSTRACT

Background: In Bangladesh, on an average 62% of total healthcare spending was borne by households through out-of-pocket (OOP) payments annually during 2000-2015. Because of such high OOP payments, a sizable proportion of households (15.7%) faced catastrophic health expenditure (CHE) and a number of them fell into poverty in 2010. Protecting households from such payments and consequently, the risk of impoverishment are desirable objectives of health systems worldwide. The Sustainable Development Goals (SDGs) resolution emphasized ensuring quality and affordable essential health services through Universal Health Coverage (UHC) by 2030. In order to achieve UHC, the World Health Organization (WHO) recommends to ensure the protection against the risk of large healthcare payments or CHE by spreading the risk among the population through pre-payments e.g., tax, social security contribution, insurance premium. Informal workers in the agricultural and non-agricultural sectors including readymade garments (RMG) workers constitute a large proportion of the total labor force (88%), who contribute to 64% of the total Gross Domestic Products of Bangladesh. Efforts should, therefore, be made to ensure sustainable quality healthcare for this group of workers by bringing them under pre-payment health schemes. Community-Based health insurance (CBHI) and employer-sponsored health insurance (ESHI) schemes were thus piloted among selected informal workers with an aim to increase utilization of medically trained healthcare providers (MTPs) at an affordable price.

Objectives: The main objective of this dissertation is twofold: firstly, to study the effect of the current healthcare financing system on the financial risk of households and secondly, to explore potential solutions through pre-payments schemes (CBHI and ESHI) for mitigating such challenges.

Methods: Based on both primary and/or secondary data, five studies were conducted. In study I, nationally representative Household Income and Expenditure Survey, 2016 has been used which provide data on household consumption expenditure including health expenses. We calculated the incidence of CHE, which was later predicted by demographic and socio-economic characteristics of the households using multiple regression analysis. The incidence of CHE was defined as the proportion of households having healthcare expenditure of more than a threshold level such as 10% of their total consumption expenditure or 40% of their non-food consumption expenditure. We estimated the impoverishment effect of OOP payments using both the national (cost of basic need approach) and the international (1.90 International dollar per person per day) poverty line. For study II, 557 informal workers were surveyed during 2010-11 in three geographic locations (a metropolitan city, a district town and a sub-district area) to estimate the willingness-to-pay (WTP) for CBHI, using the contingent valuation method.

The association between WTP and demographic characteristics was measured by employing the log-normal regression model. Study III adopted a case-control design to estimate the effect of the CBHI scheme on healthcare utilization from MTPs. We, therefore, surveyed 1,292 (646 insured and 646 uninsured) households after 1 year of implementation of the scheme. In order to minimise the unobserved baseline differences between the insured and uninsured groups, a propensity score matching was performed. A multilevel logistic regression model was applied to measure the association between MTP healthcare use and CBHI membership, in comparison to uninsured. Using the same design in study IV, a two-part regression model was applied to assess the relationship between CBHI membership and the OOP expenditure (probability and magnitude) when adjusted for other confounding factors (demographic and socio-economic). Study V utilized a case-control design with cross-sectional pre-and post-intervention surveys among workers from 7 purposely selected RMG factories (6 intervention and 1 comparison factories) in Safipur of Gazipur, Bangladesh. Randomly selected RMG workers were interviewed in pre-(October 2013) and post-intervention phases (April 2015) from insured and uninsured RMG factories. In total, 1,924 workers were interviewed (480 from the insured group and 482 from the uninsured group in pre- and post-intervention periods). We estimated the difference-in-difference (DiD) of the utilization of healthcare and OOP expenditure. The DiD is a counterfactual estimate derived by measuring the change in outcomes in the intervention group, which is deducted from the change in outcomes in the comparison group between the pre- and post-intervention periods. Beside DiD estimation, we used a two-part regression model to measure the association between OOP payments and membership of the ESHI scheme while controlling for workers' demographic and socio-economic characteristics.

Results: Study I found that CHE were faced by 24.6% of households at the 10% threshold level, the incidence was 25.3% and 22.0% among the poorest and the richest households, respectively. The poverty rate rose by 5.5% (9.0 million individuals) due to OOP payments. In study II, we observed that approximately 87% of the informal workers were willing to pay for the CBHI. The average weekly WTP was 22.8 BDT [95% confidence interval (CI): 20.9–24.8] or 0.32 USD. Monthly income, occupation, geographic location and educational level were the main determinants of WTP. Study III suggested that the insured of CBHI were 2.111 (95% CI: 1.458-3.079) times more likely than uninsured to use MTP for healthcare. Applying the two-part regression model in study IV, we found that in comparison with the uninsured, the average OOP payment was 6.4% ($p<0.001$) smaller among the insured for such healthcare utilization. Nonetheless, no significant difference was observed in OOP payments for the health service utilization from all types of providers, i.e., both MTPs and non-trained providers though the latter one was not included in the benefit package of the scheme. Study V showed that the ESHI scheme has

resulted in a significant 26.1% escalation in the utilization of healthcare (DiD=26.1; $p<0.01$) from MTPs among the insured relative to uninsured. When accounting for covariates, such utilization fell to 18.4% ($p<0.05$). The DiD calculation showed that OOP spending for insured group decreased by -3,700 BDT and -1,100 BDT in comparison to uninsured group while utilized MTPs or all types of providers respectively, although not statistically significant.

Conclusions: Reliance on OOP payments for healthcare leads to financial hardship and a challenge for securing financial protection to achieve UHC in low- and middle-income country settings with a large informal sector, like in Bangladesh. To mitigate the challenge of healthcare utilization at lower OOP payments, prepayment schemes such as CBHI and ESHI, are useful for increasing utilization of healthcare from MTPs by both informal and RMG workers. These schemes are in considerable demand that was supported by the WTP findings. However, the insured of the CBHI scheme had a significantly lower OOP payment, while worker insured by ESHI did not experience such reduction. Broader healthcare provider networks of ESHI schemes would reduce dependency on external providers (not contracted by ESHI) and consequently reduce OOP payments while increasing utilization of services.

In summary, the studies in this dissertation describe the challenges of the current healthcare financing system in Bangladesh and the substantial potential of CBHI and ESHI schemes to mitigate such challenges among the informal and RMG workers.

LIST OF SCIENTIFIC PAPERS

I. **Ahmed S**, Ahmed MW, Hasan MZ, Mehdi GG, Rehnberg C, Niessen LW, Khan JAM. 2020. Catastrophic Healthcare Expenditure and Impoverishment Related to Out-of-Pocket Payments for Healthcare in Bangladesh Evidence From Nationwide Household Income Expenditure Survey 2016. Manuscript submitted.

II. **Ahmed S**, Hoque ME, Sarker AR, Sultana M, Islam Z, Gazi R, Khan JAM . 2016. Willingness-to-Pay for Community-Based Health Insurance among Informal Workers in Urban Bangladesh. *PLoS ONE* **11**(2):e0148211. https://www.ncbi.nlm.nih.gov/pubmed/26828935

III. **Ahmed S**, Sarker AR, Sultana M, Chakrovorty S, Ahmed MW, Dorin F, Mirelman AJ, Islam Z, Rahman MH, Niessen LW, Rehnberg C, Khan JAM . 2018. The Impact of Community-Based Health Insurance on The Utilization of Medically Trained Healthcare Providers among Informal Workers in Bangladesh. *PLoS One* **13**(7):e0200265. doi:10.1371/journal.pone.0200265 https://www.ncbi.nlm.nih.gov/pubmed/ 29995899

IV. Khan JAM, **Ahmed S**, Sultana M, Sarker AR, Chakrovorty S, Rahman MH, Islam Z, Rehnberg C, Niessen LW. 2019. The effect of a Community-Based Health Insurance on the Out-of-pocket Payments for Utilizing Medically Trained Providers in Bangladesh, *Int Health.* **pii***: ihz083. doi: 10.1093/inthealth/ihz083*. https://www.ncbi.nlm.nih.gov/pubmed/31782795

V. **Ahmed S**, Sarker AR, Sultana M, Mahumud RA, Hasan MZ, Mirelman AJ, Islam Z, Niessen LW, Rehnberg C, Khan JAM. 2020. Do Employer-Sponsored Health Insurance Schemes affect the Utilization of Medically Trained Providers and Out-of-pocket Payments among Ready-Made Garment Workers? - a Case-Control Study in Bangladesh. *BMJ Open* ***0:***e030298. doi:10.1136/bmjopen-2019-030298

These papers will be referred to by their roman numerals (I-V) in the text.

CONTENTS

LIST OF ABBREVIATIONS

ADB	Asian Development Bank
ANOVA	Analysis of Variance
ATE	Average Treatment Effect
BADAS	Bangladesh Diabetic Somiti
BBS	Bangladesh Bureau of Statistics
BDT	Bangladeshi Taka
BNHA	Bangladesh National Health Accounts
brac	Bangladesh Rural Advancement Committee
CBHI	Community-Based Health Insurance
CBN	Costs of Basic Need
CHE	Catastrophic Health Expenditure
CI	Confidence Interval
DiD	Difference-in-Difference
ESHI	Employer-Sponsored Health Insurance
GCC	Grand Challenge Canada
GDP	Gross Domestic Product
GLM	Generalized Linear Model
GoB	Government of Bangladesh
GP	General Practitioner
HCFS	Healthcare Financing Strategy
HIES	Household Income Expenditure Survey
HRQoL	Health-Related Quality of Life
icddr,b	International Centre for Diarrhoeal Disease Research, Bangladesh
IG	Insured Group
ILO	International Labor Office
IPD	Inpatient Department
IT	Information Technology
LASP	Labour Association for Social Protection
LMICs	Low- and Middle-Income Countries
LR	Log-likelihood Ratio
LSTM	Liverpool School of Tropical Medicine
MBBS	Bachelor of Medicine, Bachelor of Surgery

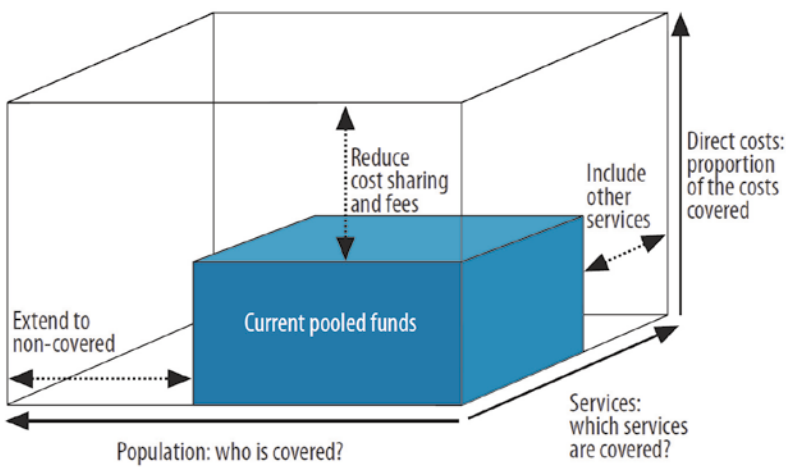
MoHFW	Ministry of Health and Family Welfare
MTPs	Medically Trained Healthcare Provider
NGO	Non-Governmental Organization
OLS	Ordinary Least Square
OOP	Out-of-Pocket
OPD	Outpatient Department
OR	Odds Ratio
PCA	Principal Component Analysis
PSM	Propensity Score Matching
PSUs	Primary Sampling Units
RESET	Regression Equation Specification Error Test
RMG	Readymade Garments
SDC	Swiss Agency for Development and Cooperation
SDGs	Sustainable Development Goals
SSK	*Shasthyo Shuroksha Karmasuchi*
THE	Total Health Expenditure
TRCL	Telemedicine Reference Center Ltd.
UG	Uninsured Group
UHC	Universal Health Coverage
UIC	United Insurance Company
UN	United Nations
USD	United States Dollar
VIF	Variance Inflation Factor
WHO	World Health Organization
WTP	Willingness-to-Pay

1 BACKGROUND

1.1 Universal Health Coverage in Bangladesh- progress and challenges

Bangladesh has achieved remarkable success in delivering primary healthcare services, such as immunization, which has significantly reduced maternal and child mortality rates (Balabanova *et al.,* 2013). Nevertheless, health service coverage remains very small, especially for the poor and vulnerable segments of society (MoHFW, 2012). In Bangladesh, households borne on an average of 62% of total healthcare expenditure (THE) each year during 2010-15 through out-of-pocket (OOP) payments (MoHFW, 2018). Because of these payments, a large proportion of households (15.7% using 10% of total spending as a threshold level) was facing catastrophic health expenditure (CHE) and many of them fell into poverty (Khan *et al.,* 2017). Therefore, preventing households from such payments is an important priority of health systems around the world (WHO, 2010). The resolution on Sustainable Development Goals (SDG) stressed the need to ensure quality and affordable basic health services globally by 2030 through achieving Universal Health Coverage (UHC) (UN, 2015). UHC means that all individuals and communities receive the promotive, preventive, curative, rehabilitative and palliative health services when they need, with sufficient quality, at an affordable price (WHO, 2010). According to World Health Organization (WHO), three dimensions of coverage should be secured to achieve UHC: 1) all segments of the population should be covered 2) a comprehensive set of quality services according to need and 3) financial protection in accessing care that avoids individuals being inhibited from accessing healthcare and protecting them from the financial consequences of OOP payments (Figure 1).

Figure 1. Three dimensions to consider when moving towards Universal Health Coverage (UHC)



Source: (Busse and Chlette, 2008; WHO, 2010)

Bangladesh is currently facing the challenges of rising healthcare costs due to epidemiological transition, increased health awareness, new diagnosis and treatment (Karar *et al.,* 2009). Bangladesh's government spent only 629.8 BDT (Bangladeshi Taka) or 6.2 USD per capita on healthcare in 2012, while per capita OOP spending on health amounted to 1,723.0 BDT (17.1 USD) (MoHFW, 2015). Private healthcare expenditure accounted for 68.6% of total health expenditure, of which 92.3% was covered by OOP payments (MoHFW, 2015). Despite significant improvement in various health indicators, there is still an insufficient supply of healthcare resources to public facilities and due to high dependency on private provisions for healthcare, limited financial risk protection is observed in the health system of Bangladesh. It is thus important to critically investigate the challenges and potential to achieve UHC in Bangladesh.

In two recent studies on measurement of UHC performance, Bangladesh scored 32% and 38% of UHC indices which indicated considerable gaps in UHC achievement in this country (Khan *et al.,* 2019; Wagstaff and Neelsen, 2020). This gap in UHC achievement can be explained by inadequate service coverage and financial risk protection due to dependency on OOP payments. Uddin *et al.,* 2010 found that the number of fully immunized children was significantly lower in rural hard-to-reach areas like in wetland (*haor*) and hills compared to the national coverage (Uddin *et al.,* 2010). Rahman *et al.,* 2017 showed that the coverage of four or more antenatal care services was 3.6 times higher in the richest quintile compared to the poorest (Rahman *et al.,* 2017). A benefit incidence analysis showed that the overall healthcare benefits in Bangladesh were pro-rich, particularly because of the private providers (Khan *et al.,* 2016). The provisions of services for rehabilitation and non-communicable conditions (including mental health) are still inadequate in the health system (Mamin and Hayes, 2018; Hossain *et al.,* 2019). These gaps in coverage of essential health services can be explained by inadequate healthcare resources, inefficiency in supply-side and lack of health awareness in the demand-side (Islam *et al.,* 2018b; Ahmed *et al.,* 2019; Joarder *et al.,* 2019). It is further noticeable that only 23% of the THE comes from tax funding and less than 2% from health insurance, which contributes barely to a limited scope of risk pooling and consequently to a low financial protection for healthcare (MoHFW, 2018).

Though Bangladesh has a comprehensive set of policies for UHC (e.g., Healthcare Financing Strategy of Bangladesh) and strong political commitment for this, there are barriers pertaining to the larger policy level which includes a rigid public financing structure dating from the colonial era (Islam *et al.,* 2018a). The other challenges include the health sector's implementation shortfalls (e.g. political interference, human resources, monitoring, and supervision) and demand-side barriers (e.g. socio-cultural factors) (Joarder *et al.,* 2019). However, progress has been made in a number of areas including the roll out of the essential package of health services

for all, expansion of access to primary healthcare services through external donor funding, and the piloting of Health Protection schemes (*Shasthyo Shuroksha Karmasuchi*) in three subdistricts (MoHFW, 2016; Ahmed *et al.,* 2018a).

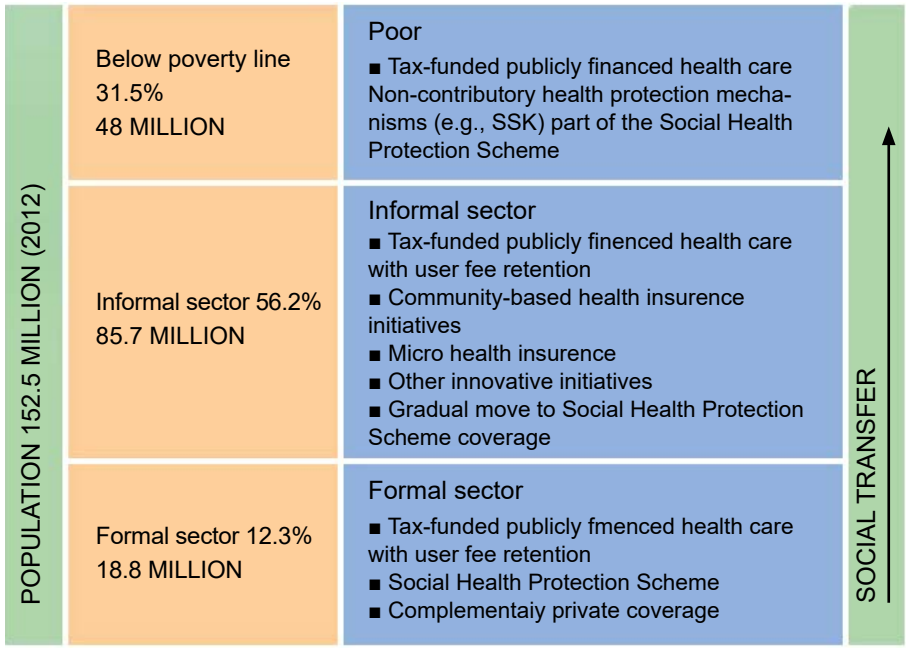
According to the International Labor Office (ILO), informal employments comprise self-employed workers, unpaid domestic workers, and employers and employees working in businesses with less than 10 employees (Hussmanns, 1998). Asian Development Bank (ADB) reported that informal workers (in the agricultural and non-agricultural sectors) alone account for 88% of Bangladesh's total labour force, which contributes to 64% of the total GDP of the country (Maligalig *et al.,* 2009). It is, therefore, necessary to provide this population with need-based quality healthcare through sustainable and affordable mechanisms of financing healthcare.

For low-income populations in Bangladesh, tax-revenue and pre-payment schemes (like Community-based health insurance/CBHI, micro health insurance) are two possible mechanisms for financing health services (MoHFW, 2012; Vargas *et al.,* 2016). The government allocates only a small portion of its budget to healthcare (5% of the government's budget in 2018-19) and even this minimum commitment is subject to political negotiations across different competing interests, i.e., education, defence (The Daily Star, 2020). Therefore, the funding healthcare for low-income people (especially informal workers) through taxation appears to be challenging for this large group of population. Apart from tax revenue, pre-payment health schemes can be a major source of generating new fund for healthcare (Vargas *et al.,* 2016).

1.2 Healthcare Financing Strategy of Bangladesh

Bangladesh's government introduced the country's first healthcare funding strategy (HCFS) as a plan for establishing sustainable and equitable healthcare financing mechanisms in the country by 2032 (MoHFW, 2012). In HCFS, different prepayment mechanisms have been proposed for three segments of the population (Figure 2) in addition to the existing tax-funded public health facility network throughout the country (MoHFW, 2012). Through publicly funded non-contributory health protection scheme, the poorest segment of the population (31.5% of the total population) will be covered. Bangladesh government is piloting the *Shasthyo Shuroksha Karmasuchi* (SSK) health protection scheme targeting this population group (Ahmed *et al.,* 2018a). The employees in the formal sector of the economy (12.3% of the total population) can be covered by social health insurance through a contribution from their salary as an earmarked health tax. The largest proportion of the population (56.2%) belongs to the informal sector of the economy with limited ability to pay. A small premium for the CBHI and micro health insurance may be applicable to this population as an interim measure. Such interim schemes might have the potential for inclusion in the social health insurance system in the long run.

Figure 2. Proposed healthcare financing strategy across different population group in Bangladesh



Source: (MoHFW, 2012).

Accumulation of prepayment contribution (e.g., income tax and social insurance contributions) from this large population at informal employment is a challenge since they have irregular income, and this income is often not traceable under the national income tax system. Therefore, besides the currently available publicly funded healthcare system, the pre-payment health schemes like CBHI, micro-health insurance schemes were recommended for securing sustainable healthcare for informal workers (MoHFW, 2012). The HCFS recommended investigating the feasibility and impact of the CBHI and micro health insurance schemes among the informal workers in the country.

1.3 Risk pooling mechanisms for mitigating effect of out-of-pocket payments

Reliance on OOP has two major consequences. Firstly, it causes severe financial hardship and impoverishment to the households (Wagstaff and van Doorslaer, 2003; Xu *et al.,* 2003; O'Donnell *et al.,* 2005; Amaya Lara and Ruiz Gómez, 2011; Khan *et al.,* 2017) and people often forced to choose harder coping mechanisms such as interest borrowing, asset selling (Rahman *et al.,* 2013a). Secondly, it leads to

an unmet need for healthcare because of unaffordability by low-income and poor people. This often leads low-income and poor people to seek healthcare from non-trained providers, who are cheaper, but in many cases, it may result in adverse effects on health or inadequate care (Donnell, 2007). These dual consequences of OOP expenditure, i.e., CHE and inadequacy of healthcare address two dimensions of UHC namely, the 'financial protection' and 'service coverage' (WHO, 2010). To achieve UHC, the WHO recommends that protection against the risk of large healthcare costs or CHE be assured by the distribution of risk among the population by pre-payment (WHO, 2010). As presented in the HCFS, the inclusion of informal workers in risk pooling mechanisms (e.g., social health insurance) is a challenge because of their irregular income and the difficulty of collecting contributions from them through the tax system (Akazili, 2010; Vargas *et al.,* 2016). Occupational associations/cooperatives and the employer-financed scheme could be a base for engaging such workers for healthcare financing (Devadasan and Nandraj, 2006; Akazili, 2010; Khan and Ahmed, 2013).

1.4 Community-based health insurance scheme (CBHI)

CBHI is a not-for-profit insurance scheme aimed primarily at the informal sector and formed on the basis of a collective pooling of health risks and in which the members participate in its management (Devadasan and Nandraj, 2006). Occupational associations/cooperatives can provide a platform to engage informal workers in healthcare financing through the initiation of the CBHI (Akazili, 2010; MoHFW, 2012). Bangladesh appears to have little experience with such healthcare financing schemes despite its potential to create such schemes using cooperatives of informal workers (Sarker *et al.,* 2016; IHCO, 2018).

A CBHI scheme, consisting of a group of informal workers, was piloted through a cooperative called the Labour Association for Social Protection (LASP) for ensuring access to quality healthcare for them. The scheme's enrolment was voluntary. Several marketing interventions were conducted to increase the enrolment in the scheme (such as group meetings and individual marketing staff counselling). The unit of enrolment was the household of the informal workers. A brief description of the CBHI scheme is presented below:

- Target population: Informal low-income workers and their family members in the sub-district of Chandpur (including urban and rural areas) in Bangladesh.
- Implementation entity: Cooperative under the Ministry of Local Government, Rural Development and Co-operatives

- Beneficiaries: For one membership card, six members of each household are entitled to the benefits of the scheme. The children under the age of 5 years were compulsorily enrolled in the scheme and not counted under the beneficiary limit.
- Benefit package: (Table 1).
- Premium: 600 BDT (USD 7.72) per household per year, which is 2.68% of the annual average income of informal workers (22,352 BDT or USD 287.6 (ADB, 2010)

Table 1. The service package of the community-based health insurance scheme

Services	Co-payment/description
Health benefits	
GP Consultation	30 BDT (Market price=300 BDT[a])
Medicine	20% discount from maximum retail price
Diagnostic tests	50% discount on market price
Specialist Doctor's consultation	100 BDT (Market price=500 BDT)
Hospitalization	Maximum 4,000 BDT per household per year
Periodic satellite clinics in remote rural areas	Free of charge
Non-health benefits	
Savings opportunity	▪ Minimum 10 BDT and maximum 100 BDT per week per household ▪ Member can withdraw saved amount with 10% interest after 1 year period
Training programs	▪ 3 months long computer training for the student member of the household with a cost 1,200 BDT (market price=4,500BDT) ▪ 6 months long sewing training for female workers (free of charge)

[a]1USD=77.8 BDT (Bangladesh Bank, 2015)

There was a uniform package of benefits for all members of the CBHI scheme. The scheme provides health insurance to members through its appointed paramedics and General Practitioner (GP) and contracted specialists as well as licenced private healthcare facilities. The specialised doctors and healthcare facilities have been contracted for providing referral care (referred by GP). The per-case payment system was used to pay for specialist doctors and diagnostic testprovider. The paramedics and GPs were salaried monthly by the scheme. To our knowledge, there was no other health insurance scheme in the region during the project period.

1.5 Employer-sponsored health insurance scheme (ESHI)

With 4.2 million workers, the RMG sector has emerged as one of Bangladesh's largest pools of employers and foreign currency earner. This sector contributed significantly to the economy by exporting more than 34.13 billion USD (84% of all exports) in the financial year 2018-19 (Textiletoday, 2019). Despite their strong contribution to the economy, the workers do not receive adequate social protection. Relative to formal jobs, RMG workers are more vulnerable to many forms of occupational diseases (Akhter S, Salahuddin A, Iqbal M, Malek A, 2010; Alamgir *et al.,* 2013). A study revealed that among the RMG workers, 38%, 29%, and 28% suffered from diarrhoea, cough, and breathlessness respectively and these are the prevailing symptoms among them (Rahman and Rahman, 2013). These employees have limited access to quality healthcare as it has been noted that about 11% of RMG workers have received no treatment for their disease and most of them consult with local healthcare providers who have Local Medical Assistance and Family Planning training (56%) followed by drug sellers (21%) and traditional healers (10%) (Rahman and Rahman, 2013). Another study of 300 RMG workers showed that they had obtained no vaccination, health education or information related to health issues from the garment factories (Haque *et al.,* 2008). There was no provision for themselves and their family members of the health centre, doctor, medicine and treatment for fire burning and chronic diseases. About two-thirds (63%) of the respondents reported having lost their working days due to illness (Haque *et al.,* 2008).

For the organized workforce, industry-based 'Employer-Sponsored Health Insurance' (ESHI) has been used in developed countries and proposed for developing countries to secure access to quality healthcare and financial risk protection (Gould, 2013; Kutzin, 1998). An employer usually offers these insurance plans as part of the benefits and compensation package for employees. Considering the inadequate accessibility of RMG workers to healthcare, Bangladesh Diabetic Somiti (BADAS), a Bangladesh Diabetic Association established in 1956 (Uddin, 2012), implemented a research-based ESHI pilot scheme during 2014-2015 (Box 1). The pilot study was collaborated by the United Insurance Company (UIC), Telemedicine Reference Center Ltd (TRCL), and the New Asia Group (RMG factories).

Box 1. Employer-sponsored health insurance scheme

Description of the employer-sponsored health insurance scheme
Target population: Workers of RMG factories **Implementation organizations: (Third-party payment mechanism)** 1) Diabetic Association of Bangladesh (BADAS) (Health Service Provider) 2) United Insurance Company Limited (Insurance company) 3) The New Asia Group (RMG factories) **Benefit package:** 1) Inpatient and outpatient treatment covered by the insurance scheme with maximum coverage of 15,000 BDT (192.8 USD*) per year **Premium:** 487 BDT (6.3 USD) per year, which is borne by the employer. **Number of enrolees:** 8,000 RMG workers from 6 factories

*1 USD = 77.8 BDT (Bangladesh Bank, 2015)

It should be noted here that some diseases and conditions of health were predominantly omitted by the scheme due to high and unaffordable service costs. Such services comprise congenital infirmity, radiotherapy (X-ray, radium or radioactive isotopes treatment), dental care that does not require hospitalization for reconstructive surgery as a result of an accident, chemotherapy or any form of care when not supplementary or necessary to the treatment of the injury/illness which caused the hospitalization, special procedures, i.e., transplantation, cardiac, neurosurgery, face surgery, dialysis, HIV/AIDS.

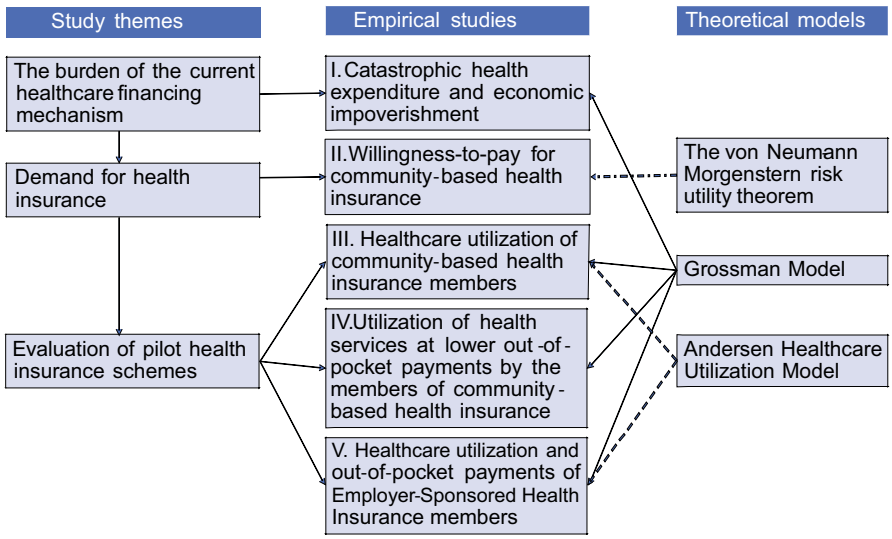
The ESHI scheme provided health insurance to workers of six New Asia Group garment factories (Knit-Asia Ltd, Ashulia; Knit-Asia Ltd, Shafipur; Knit-Asia Ltd, Nichintapur; Malek Spinning Mills Ltd; Salek Textile Ltd and Rahim Textile Mills Ltd) in Shafipur of Gazipur, Bangladesh. A total of 8,000 workers were enrolled in the insurance scheme. It needs to be noted here that BADAS has a network of 80 health facilities and medical education centres throughout the country (Uddin, 2012). However, health services to the ESHI enrolees were provided only from a newly built BADAS hospital located in Shafipur due to its proximity and from a tertiary level referral hospital located in Shahbag, Dhaka.

The pilot scheme offered an annual healthcare coverage of up to 15,000 BDT (192.8 USD) per worker per year. The premium of the scheme was 487 BDT (6.3 USD) per worker per year, which was borne by the RMG factories/employer. BADAS and UIC experimented with the ESHI scheme at a small scale and sought a scaling-up mechanism and technical assistance to carry out this process in a professional manner. The approach was to develop a scalable, RMG-funded ESHI scheme, i.e., employer-paid premium, linked to the health service and insurance provider to create a sustainable mechanism for health financing. This ESHI scheme was piloted with the aim of providing the RMG workers in Bangladesh with financial protection for quality healthcare.

2 THEORETICAL FRAMEWORK

The five studies in this thesis utilized different theoretical models within the area of healthcare and economics for conducting empirical investigations (Figure 2). The Von Neumann- Morgenstern, Grossman, and Andersen Healthcare Utilization Models were thus applied in different studies. Figure 3 summarizes the connections of the empirical studies to these theoretical models.

Figure 3. Theoretical models under the empirical studies



2.1 The von neumann- morgenstern risk utility theorem

The demand for health insurance can be explained using the Von Neumann-Morgenstern risk-utility theorem (Neumann and Morgenstern, 1953). According to this theorem, under certain axioms of rational behaviour, a risk-averse individual behaves as if he or she is maximizing the expected utility value of his/her wealth. It shows that risk-averse individuals accept a reduction in their wealth if this permits them to escape the risky situation. The individual prefers a lower wealth with a certain probability than the high value of wealth with uncertain probability as the expected utility is higher for the former situation. The willingness-to-pay (WTP) corresponds to the amount that one is willing to give up from his/her wealth for maintaining a certain wealth level with health insurance i.e. irrespective of health condition (Zweifel, 2007). This is an estimate of the premium the individual is willing to pay for the risk aversion. This includes the expected value of loss and an excess amount for loading cost (administrative cost and profit of insurer) depending on the degree of risk aversion offered by the health insurance. In study II, we estimated the WTP of the informal workers for the CBHI scheme, considering the von Neumann- Morgenstern risk-utility theorem.

2.2 Grossman model

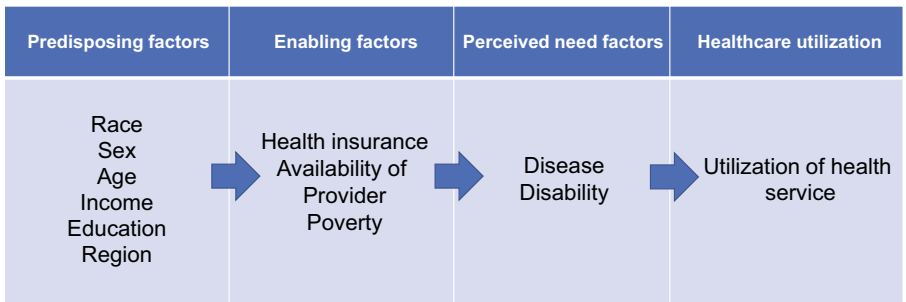
The Grossman model explains the factors that influence the demand for health and medical care, outlined by Michael Grossman in a monograph in 1972 (Grossman, 1972; Folland *et al.,* 2007). In this model, health has been considered as both consumption and investment goods. Individuals 'feel good' by possessing good health status, which has been referred to as the consumption aspect of health. Individuals further can improve his/her own health by investing in, for instance, by health awareness, education, healthy diet, physical exercise, medical care, and so forth and such improved health can be utilized for enhancing economic outcomes (like higher income). However, the model was extended further by other researchers to study health insurance, healthcare spending and the relationship between education and health (Muurinen, 1982; Jowett, 2004; Galama and Galama, 2011). It was argued that individuals who face illness/depreciation in health seek medical care as inputs to reproduce health. Further, individuals derive pleasure from good health status and indirectly invest in market and non-market activities. Investment in health will be optimal when the marginal cost of health production equals the marginal benefits of the improved health status in the form of healthy time. Therefore, healthcare utilization and health spending are associated with socio-economic status (e.g., income, education) of the individuals. Selden 1993 argued that uncertainty of illness could increase the health spending among the poor (e.g., informal worker) (Selden, 1993) which may further increase the chance of CHE in the absence of any risk pooling mechanisms for financing healthcare. This is because the poorer are more vulnerable to any losses in income due to ill health (O'Donnell *et al.,* 2005) and consequently may face catastrophic health spending (Khan *et al.,* 2017). We studied the incidence of CHE across socio-economic groups in study I. As being sick is a higher burden on the poor, they should be more inclined to spend on preventive measures that will increase their stocks of health capital and reduce the risk of high OOP payments (Selden, 1993).

Further, the Grossman model pointed out that demand for health is derived from the demand for health services. Similarly, the demand for health insurance is derived from the demand for health services. The insurance premium is like an investment in health since it gives access to health services, which may enhance health status in case of illness (Jowett, 2004). We assessed the demand for health insurance and its determinants in study II. We, further, investigated if insurance enrolment, which is considered as an investment in health, influenced level of healthcare utilization in study III and V.

2.3 Andersen healthcare utilization model

The Andersen Healthcare Utilization Model was developed by Ronald M. Andersen in 1968 (Andersen and Newman, 1973). This conceptual model demonstrates that the usage of health services is determined by three dynamics, i.e., predisposing factors, enabling factors, and need factors. Predisposing factors consist of, for instance, demographic and socio-economic characteristics as well as health beliefs (Figure 4). Examples of enabling factors are family support, educational level, availability of healthcare providers, distance to the nearest healthcare provider and health insurance. Need factors can be both perceived and the actual need for healthcare services, which can be reflected in illness.

Figure 4. Andersen healthcare utilization model



Source: Modified from (Andersen and Newman, 1973)

The predisposing factors (e.g., age, sex, marital status) and need factors (e.g., types of symptom/illness suffered) were considered as confounding factors in my studies III and V. The WTP for health insurance can be considered as predisposing factors since it reflects demand for health insurance which is an enabling factor for healthcare utilization. We studied health insurance as a factor for utilizing medically trained providers in study III and V.

3 AIMS

3.1 Overall aim

The main objective of this thesis is twofold: firstly, to study the impact of the existing healthcare financing system on the financial risk of households and secondly, to explore potential solutions to mitigate such risk through community-based (CBHI) and employer-sponsored health insurance (ESHI) schemes.

3.2 Specific objectives

The following central research questions were investigated to meet the main aim of the study:

I. To what extent does the out-of-pocket healthcare financing method increase the financial risk of households?

II. What is the magnitude of willingness-to-pay (WTP) among informal workers for CBHI?

III. Does CBHI increase healthcare utilization of informal workers from medically trained healthcare providers (MTPs)?

IV. Does CBHI reduce out-of-pocket health expenditure for utilizing healthcare from MTPs among informal workers?

V. Does ESHI increase utilization of health services from MTPs and decrease out-of-pocket payments for such health services of ready-made garment workers?

4 METHODS

Five studies have been conducted using primary and/or secondary data. Bangladesh Household Income and Expenditure Survey (HIES), 2016, was used to investigate the effects of high OOP payments on the financial risk of households for healthcare (Study I). The Contingent Valuation Method was used to assess the demand for health insurance in terms of WTP (Study II). To investigate the effects of health insurance schemes, the quasi-experimental case-control study was conducted (Study III and IV). The comparison was made between the intervention group (enrolled workers in the insurance scheme) and comparison group (matched uninsured workers) in terms of use of services by eligible providers and health service recipients' OOP expenses. Cross-sectional pre-post surveys were conducted among the insured and uninsured RMG workers for assessing the effects of the ESHI scheme on the utilization of healthcare and their dependency on OOP payments (Study V). Table 2 summarises the design, data sources, analyses and outputs of all five studies.

Table 2. Overview of the five studies of the thesis

Study characteristics	**Study I**	**Study II**	**Study III**	**Study IV**	**Study V**
Design	Cross-sectional study	Cross-sectional study	A case-control study with propensity score matching	Same as study III	A case-control study with a cross-sectional survey in pre- and post-intervention periods
Inclusion criteria and population	The general population of Bangladesh (nationally representative sample)	Informal workers aged over 18 and have at least 1-year experience in the current occupation	Insured households of the CBHI scheme and matched comparison from the same area, household composition, location (same village) and household income	Same as study III	Insured and uninsured ready-made garment workers working in the selected factory for the last six months period

Sample size and data sources	Household Income and Expenditure Survey 2016 conducted by the Bangladesh Bureau of Statistics	557 informal workers were interviewed. Primary data were collected through a household survey.	In total 1,292 (646 insured and 646 uninsured) house-holds were surveyed	Same as study III	1,924 (480 from the insured and 482 from the uninsured, in pre- and post-intervention period) ready-made garment workers were surveyed from the insured and uninsured ready-made garment factories respectively
Outcomes	Incidence of catastrophic health expenditure and impov-erishment due to out-of-pocket healthcare payments	Willingness-to-pay for CBHI among informal workers	Utilization of medi-cally trained healthcare providers by informal workers	Out-of-pocket payments for utilizing medically trained healthcare providers by the informal workers	Utilization of medically trained health-care providers and related out-of-pocket payments among ready-made garment workers
Control variables	Age, sex, marital sta-tus, house-hold size, education level, monthly income, ill-ness in the last 6 months, location, occupation	Age, sex, marital sta-tus, occu-pation, education level, monthly income, ill-ness in the last 6 months, location, occupation	Age, sex, marital sta-tus, occu-pation, education level, loca-tions, illness or symptoms suffered, inpatient care utiliza-tion, house-hold size and asset quintiles	Age, sex, marital status, occupation, house-hold size, education level, wealth quintiles, illness or symptoms suffered and inpa-tient care utilization	Age, sex, marital status, occupation, education, ill-ness or symp-toms suffered and inpatient care utilization, health insur-ance status, household size and income
Econometric analysis	Descriptive, chi-square test, multi-ple logistic regression	Descriptive, one-way analysis of variance (ANOVA), log-linear regression model	Descriptive, propensity score match-ing, chi-square test, independ-ent sample proportion test, multi-level logistic regression model	Descriptive analysis, propen-sity score matching, two-part regression model	Descriptive analysis, difference-in-difference and two-part regression model

The details of the methods used in each study will been described in the following section.

4.1 Methods applied in the sub-studies

4.1.1 Study I

HIES is commonly used worldwide, especially in low-income developing countries, to assess poverty levels and people's living standards. HIES in Bangladesh is a periodic cross-sectional survey conducted every five-year period by the Bangladesh Bureau of Statistics (BBS). In study I, we used secondary data from the most recent HIES in 2016. This survey provides useful data on household income, expenditure, consumption, savings, condition of housing, schooling, employment, health and sanitation, accessibility to safe drinking water and electricity supply. HIES used a stratified random sampling method in two stages. In the first stage, Primary Sampling Units (PSUs) throughout the country from 20 strata (8 rural, 8 urban, and 4 metropolitan areas) were randomly selected for national representation and in the second stage, households within each PSU were randomly selected (BBS, 2016). Using this sampling method, a total of 46,076 households were included in HIES 2016. However, 45,977 households reported the expenditures information (Appendix 1). The HIES survey provided data on household OOP spending for healthcare in the last 30 days for outpatient services and 12 months for inpatient services (prior to data collection) and details of households' other spending (BBS, 2016). These data were used to measure the incidence of CHE as a result of OOP expenses and their effects on the impoverishment (using the national poverty line) of households. The incidence of CHE was derived from a fraction of the healthcare expenses in comparison to household total consumption spending that crosses a certain limit (Wagstaff and van Doorslaer, 2003). For CHE incidence estimation, there is no single agreed threshold. However, two definitions are often used; firstly, OOP payments for healthcare more than 10% of total consumption expenditure (Pradhan and Prescott, 2002; Wagstaff and van Doorslaer, 2003; Russell, 2004) and secondly, more than 40% of total non-food consumption expenditure (Berki, 1986; Xu *et al.,* 2003, 2006). We estimated the incidence of CHE using both threshold levels for clarity. The headcount of poverty was calculated using total household spending and such spending on health without OOP payments. The gap between these two headcount measures reflected the effect of OOP expenditure on impoverishment (Wagstaff and van Doorslaer, 2003). We estimated this using both the national and the international (1.90 Int dollar per person per day) poverty lines. To measure the national poverty line, the BBS implemented the Costs of Basic Need (CBN) technique, which implies that this poverty line is the minimum amount of per capita spending at which each household member can attain their required basic needs including both food and non-food items (BBS, 2011). For the food poverty line, the market value of common eleven food items (rice, wheat, pulses, milk, oil, meat, fish, potato, other vegetables, sugar and fruit) consisting of 2,122kcal per individual per day was recorded. Then the non-food part of the poverty line was calculated as the median amount spent on the non-food items (excluding irregular spending) by each household member in food poverty. Finally, the overall poverty line was estimated by adding the food and non-food poverty line together (BBS, 2011). For identifying the determinants two multiple logistic regression models

were used considering CHE and impoverishment as dependent variables separately in each of the models. The socio-economic characteristics (e.g., sex and education level of household head, household size, asset quintiles, and geographic locations), chronic illness, healthcare use from private and so-forth were used as the explanatory variables in these models. The Principal component analysis (PCA) approach was used to construct the asset quintiles using the households assets information (Filmer and Pritchett, 2001; Vyas and Kumaranayake, 2006).

4.1.2 Study II

The bidding game version of the contingent valuation method was used to estimate weekly WTP for CBHI (Drummond *et al.,* 2008). A total of 557 informal workers were surveyed from three occupational groups (rickshaw-puller or drivers of human-driven tricycle, shopkeepers and restaurant workers) in three locations in Dhaka (a metropolitan city), Chandpur (a district town) and Nobinagar / Savar (a sub-district). The workers' cooperatives and market places were identified using transect walks and informal discussions with community leaders and members. A list of workers was then collected from the workers' representatives/leaders. Workers were asked about their demographic characteristics, monthly income, and spending, past six-month history of illness, bidding questions on WTP for CBHI and so forth. The benefit package a health scheme for low-income people, offered by the *Gonoshasthaya Kendra (*Public Health centre – a health NGO) was used for eliciting the WTP for health insurance (Table 3).

Table 3. The service package of the health insurance product for estimating willingness-to-pay

Health services	Co-payment
Outpatient	
Medical officer visit	Free of cost
Specialist visit	60 BDT
Inpatient	
Bed-Payment per day	50 BDT
Diagnostic tests	
Ultra-sonography	75-150 BDT
ECG	50 BDT
Most of the low-cost tests (Like, Blood grouping, Hb%, Stool test, Random Blood Sugar)	Free of cost
Some tests (like Blood TC/DC/ESR, Urine RE)	10 - 200 BDT
Blood transfusion of neonatal	500 BDT
Other treatment of neonatal	Free of cost
Normal delivery	100 - 500 BDT
Caesarean and other surgery	2000 - 3000 BDT
Orthopaedic surgery	3000 - 4000 BDT

Appendicitis	100 BDT
Gall bladder operation	3000 BDT
Medicine	50% discount on the maximum retail price set by the government

After illustrating the benefit package and the process of health insurance, each interviewee was asked if they were willing to participate with their household members in a CBHI scheme. The bidding game was then used to determine the maximum price (premium) a participant was willing to pay for a four-member household. Since the WTP estimates could be biased by the starting bid, it was assigned randomly during the interview to reduce such effect (Drummond *et al.,* 2008). Average and median WTP was calculated, and a one-way analysis of variance (ANOVA) test was performed to assess the differences across occupational groups and locations. The PCA approach was applied using information on housing materials, access to basic facilities such as water and sanitation, durable goods, and livestock for constructing the asset quintiles (Filmer and Pritchett, 2001; Vyas and Kumaranayake, 2006).

Econometric analysis: The multiple regression model was used to predict WTP on the basis of demographic and household characteristics, occupation, level of education, and previous illness history of the study participants. The natural logged WTP was predicted based on respondents' demographic and socio-economic characteristics. Folland *et al.,* (2007) produced a theoretical model in which premium, income or asset, health status and risk of income loss can affect demand for health insurance (Folland *et al.,* 2007). Other researchers have identified similar factors in empirical investigations (Churchill, 2006; Cohen and J Sebstad, 2006; Leftley and Mapfumo, 2006; McCord, 2008). The model below was used in the analysis:

$$\ln(Y_i) = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + ... + \varepsilon_i$$
$$i = 1, 2, ..., n$$

Where Y_i denotes WTP for joining an insurance scheme, β_0 is a constant, X_1, X_2, X_3,……denote the control variables, β_1, β_2, β_3,…represents the coefficient that shows the magnitude and direction of the relationship of corresponding variables with Y, and ε is an error term. Since the natural logarithm of WTP was used as the dependent variable, the coefficients represented either semi-elasticities (if the independent variable is in natural units, e.g., age) or elasticities (if the independent variable is logarithmically transformed, e.g., income) (Gujarati and Porter, 2008). A series of diagnostic tests are performed, such as tests on the presence of heteroscedasticity, multicollinearity, and omitted variables.

Further, we performed a regression model analysis using the WTP share of income as the dependent variable with the demographic and socio-economic characteristics of the respondent as independent variables. Since the dependent variable, in this case, is a proportion (WTP as a share of income), the Generalized Linear Model (GLM) with binomial family and logit link function was applied as proposed by Papke & Wooldridge, 1996 (Papke and Wooldridge, 1996).

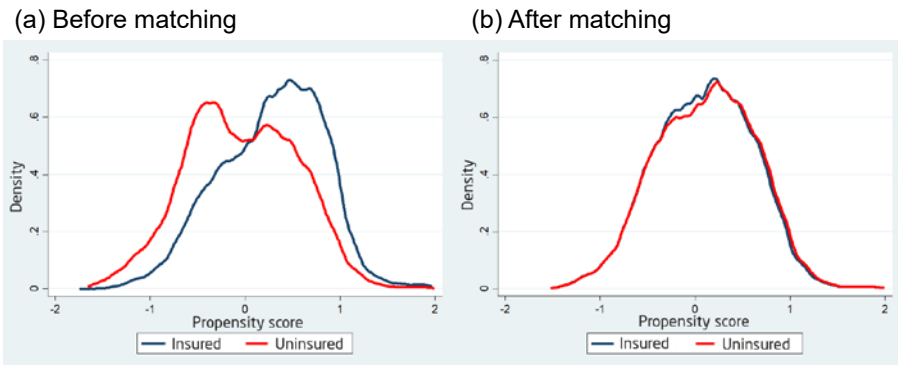
4.1.3 Study III

The informal workers who joined the cooperative organization (intervention) were compared to those who did not (comparison) to study the effect of the CBHI scheme on the use of healthcare. An earlier study found that in the uninsured population, the health service utilization rate was 6.2% (Dror *et al.,* 2005) and it was expected that the health insurance can increase such utilization by 5% (Aggarwal, 2010). Using this difference in healthcare use between insured and uninsured groups, 777 households were estimated to require as samples from each of intervention and comparison groups (1,554 households in total) to conduct this study, considering 90% power and 10% non-response rate (Casagrande and Pike, 1978; Ury and Fleiss, 1980). From the list of all insured households, random sampling was performed for selecting them for the survey. For each insured one uninsured household was identified from the same village with a similar occupation of the household head. The head of the household was interviewed using a structured questionnaire. During the survey, 1,292 households (83.1% response rate) with a total of 6,694 persons (insured, 3,548; uninsured, 3,146) responded to this questionnaire. Questions related to household socio-economic characteristics and their utilization of different types of healthcare providers (including both medically trained and untrained providers) in the last 90 days were asked in this survey. MTPs included general practitioners/MBBS doctors, specialized doctors, private clinics, medical college and district hospitals, the Upazila Health Complex and NGO clinics as these healthcare organisations employ medically educated staff. The village doctors, drug sellers and traditional healers were classified as non-trained providers (Ahmed *et al.,* 2009). A chi-square test was performed for testing if there was a significant difference between insured and uninsured groups in the use of health services from MTPs. Lastly, multilevel logistic regression was applied as detailed in the section below 'Multilevel logistic model' to assess the association between CBHI enrolment status and utilization of MTPs, while controlled for types of occupation, demographic and socio-economic characteristics, geographic location and so forth. The PCA approach was applied for constructing the asset quintiles using the household asset information (Filmer and Pritchett, 2001; Vyas and Kumaranayake, 2006).

Propensity score matching: Since the baseline information for intervention and comparison groups were not available in this study, baseline bias can exist after direct matching of household and individual characteristics. Therefore, to minimize the baseline

difference in the characteristics, a propensity score matching (PSM) approach was employed in estimating the impact of the CBHI scheme on the utilization of healthcare from MTPs (Rosenbaum and Rubin, 1983; Wagstaff *et al.,* 2009). The PSM is a statistical tool which weights differences in observable variables between the individuals of insured and uninsured households. A logistic model was employed for estimating the propensity score. Based on the closeness of the estimated propensity score of each individual from the insured group to the individual from the uninsured group, a matched sample was drawn. The radius matching method was used to estimate the matched sample using the recommended caliper size (standard deviation of the logit score is multiplied by 0.2) (Austin, 2011). Figure 5 shows the propensity score distributions in the insured and the uninsured groups before propensity score matching application and after matching. Before propensity score adjustment, the insured and uninsured group were dissimilar with regard to the characteristics measured by the propensity score, and after matching, they are similar. After matching 2,519 individuals from each group were included in the analysis. In the matched sample, 639 households were from the insured group and 611 households were from the uninsured group. After matching no significant difference in demographic and socio-economic factors was observed except age-group ($p<0.05$) between insured and uninsured group (Appendix 2).

Figure 5. Distribution of propensity score in the insured and uninsured groups before propensity score matching application and after matching



Multilevel logistic model: The multilevel logistic model was used to predict the likelihood of healthcare utilization from MTP by health insurance status while controlling for demographic and household socio-economic characteristics. We used this analysis to account for the hierarchical structure of the two levels of data (Subramanian *et al.,* 2003). The primary explanatory variable of interest in this analysis, membership in the CBHI scheme, was at the household level, and the dependent variable healthcare utilization from MTP was at the individual level. As control variables, we included individual characteristics such as age, sex, education,

illness frequency and type of illness and household characteristics such as asset quintiles and household size. From this analysis, we estimated the significant difference in the utilization of MTPs between intervention and comparison as well as the magnitude of that difference. The model was specified as:

$$\text{logit}\,(Y_{ij}) = \beta X_{ij} + \gamma w_j + r_{ij}$$

Where X_{ij} is a vector of characteristics of i^{th} participants living in j^{th} household, and wj is a vector of household characteristics. The coefficient β characterizes partial association between individual characteristics (like, age, sex, marital status, occupation, education, illness or symptoms suffered and inpatient care utilization) and utilization of healthcare from MTP whereas; γ characterizes the partial association between household characteristics (like, health insurance status, household size and asset quintiles) and such healthcare utilization. The r_{ij} is an error term. We estimated the odds ratio and its 95% confidence interval from this analysis.

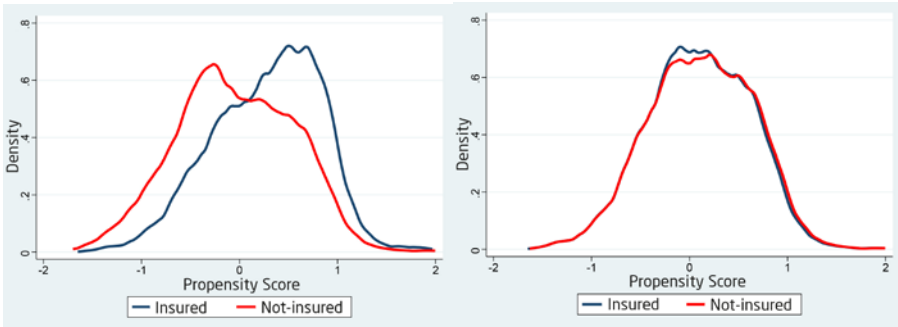
4.1.4 Study IV

OOP payments for healthcare were defined as any payments related to medical fees, user fees for public care, purchases of medicines (whether prescribed or not), co-payments for insurance, and payments for equipment and diagnostic tests (van Doorslaer *et al.,* 2006). This study used the same sample (1,292 households) of study III. Average and median OOP payment estimates were compared between 'insured' and 'uninsured' groups, taking into account different dimensions such as income, occupations, household size, geographic locations. To test the statistical significance of the difference in OOP payments between insured and uninsured groups, the Wilcoxon-Mann-Whitney and two-way ANOVA tests were performed. The two-part regression model was used to determine the relationship between OOP expenses and the CBHI scheme while controlled for some confounding factors including demographic and socio-economic characteristics, occupational conditions etc.

Similar to study III, we applied the PSM approach to identify a matched sample for the insured and uninsured group from the collected data. The overall approach was similar as explained in section 4.1.3. However, we used OOP payments as the outcome variable in this matching. Figure 6 shows the distribution of propensity scores before and after matching in the insured and the uninsured groups. Before propensity score adjustment, the insured and uninsured groups were dissimilar with regard to the characteristics measured by the propensity score, and after matching, they are similar. Finally, 2,502 individuals from the insured group and the same number from the uninsured group were included in the analysis. There was no significant difference in background characteristics between insured and uninsured except age group (Appendix 3).

Figure 6. Distribution of propensity scores in the insured and uninsured groups before and after matching

(a) Before matching (b) After matching



Econometric analysis: Two-part regression analysis was conducted to estimate the effect of individuals' enrolment in the CBHI scheme on OOP payments for seeking healthcare from the MTP. We additionally estimated the association of OOP payments with healthcare utilization from non-trained providers. The OOP payment was a limited dependent variable and was continuous over most of its distribution but had a mass of observations at zero values. The decision of healthcare expenditure and the magnitude of expenditure might not be statistically independent (Jones, 1989; Okunade *et al.,* 2010). Application of an Ordinary Least Square (OLS) estimation method of regression coefficient to only part of the sample who spent for healthcare raised the possibility of sample selection bias (Jones, 2000). In this case, a two-part regression model was applied (Okunade *et al.,,* 2010; Rahman *et al.,* 2013b). The first part involved the likelihood of incurring any healthcare costs, where 0 and 1 meant 'no cost' and 'any cost' respectively. This was incorporated in the two-part model with a logit function. The second part considered the magnitude of OOP healthcare payments. An ordinary least square function was used to model it with the consumption decision. Thus the two-part model used the information on both the probability and magnitude of OOP payments for healthcare simultaneously in assessing predictors like enrolment in the CBHI scheme along with other covariates (Cragg, 1971; O'Donnell *et al.,,* 2008). In summary, the dependent variable for the logit model was a dichotomous variable that indicated whether OOP expenses were incurred (the participation decision). The ordinary least square regression model part analyzed the natural logarithm of OOP payments (Yi) as a function of the covariates (Rahman *et al.,* 2013b). In addition to the main variable of interest, i.e., 'membership of the CBHI scheme' several control variables like asset quintiles, education level, household composition, healthcare utilization, geographic location

and health condition were included as control variables in the regression model. The model is presented in the equation below (O'Donnell *et al.,* 2008),

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \ldots + \varepsilon i \qquad \varepsilon_i \sim IN(0, \sigma^2)$$

Observed OOP payments are assumed to be,

$$Y_i = \begin{cases} Y_i, \text{ if } Y_i > 0 \\ 0, \text{ otherwise} \end{cases}$$

Where, Y_i= the natural logarithm of OOP payments, β_0 is a constant, X_{1i} indicates if the household had membership in CBHI scheme with values 0 or 1 (0= did not have a membership, 1= had membership), β_1 is the coefficient that shows magnitude and direction of relationship with insurance status, X_{2i}, X_{3i}... denote control variables, β_2, β_3 ... represent the estimated coefficients, and ε_i is the random error term of the model.

The Tobit model also can address the problem with a large number of zero responses of the dependent variable. Although the two-part model is a more popular approach to modelling medical expenditures and preferred by O'Donnell *et al.,* 2008 (O'Donnell *et al.,* 2008), we included findings from Tobit model in Appendix 8. The 95% confidence interval was presented for the coefficients of regression analysis.

4.1.5 Study V

The ESHI scheme included workers in six RMG factories located in Safipur of Gazipur, Bangladesh. The comparison group was the workers at a purposefully chosen RMG factory situated in the same location, where health insurance was not offered. Data was collected in two-time points, namely pre-and post-intervention periods, for both intervention and RMG comparison factories. Using rates of healthcare utilization for two groups (7.6% in diagnosis and 6.2% in the comparison group) at an error level of 10% and power of 85%, 372 workers were required per group for assessing the effect. Considering the 30% drop-out between pre-and post-surveys, a total of 1,936 garment workers (484 intervention and 484 comparisons each period) were required (Dror *et al.,* 2005; Ury & Fleiss 1980;

Casagrande & Pike 1978). Finally, 1,924 workers were responded (480 from the IG and 482 from the UG in pre-and post-intervention periods) to the survey.

The difference in Difference (DiD): The DiD approach was used to quantify observable differences in OOP expenditures and the use of MTPs by ESHI scheme participants and non-participants. The DiD is a counterfactual estimate derived by measuring the change in outcomes in the intervention group, which is deducted from the change in outcomes in the comparison group between the pre- and post-intervention periods (Gertler *et al.,* 2011). If we assume that factors affecting the outcome other than the ESHI scheme remained stable in the insured (IG) and uninsured (UG) groups over time or followed a parallel change, then a DiD analysis will uncover the net effect of the scheme on the outcome (Rao *et al.,* 2014). The table below illustrates the idea of DiD (Table 4),

Table 4. Difference-in-difference estimate

	Pre-intervention	Post-intervention
Intervention	A	B
Comparison	C	D

In this case, the DiD estimate of the intervention effect is: (B – A) – (D – C) (Gertler *et al.,* 2011).

In this study, we used the regression technique to measure the DiD (Meyer *et al.,,* 1995). Two dummy variables S (1= Insured, 0= Uninsured) and T (1=post-intervention and 0=pre-intervention) were generated and inserted into a regression model with outcome variables (Y) such as OOP healthcare expenses. The regression model for DiD estimation was specified as below,

$$Y_i=\beta_0+ \beta_1 T_i+ \beta 2 S_i+ \beta_3 (T\times S)_{it}+\varepsilon_i$$

The estimated β_3 presents the DiD of the outcome variables.

Econometric analysis: Like study IV, to avoid the issues related to large number of zero responses in OOP spending, the two-part regression model was used to assess the association between ESHI scheme enrollment and the participation decision and magnitude of OOP healthcare expenditure while controlling for covariates (e.g., socio-economic and demographic characteristics) (Okunade *et al.,* 2010;

Rahman *et al.,* 2013b). The two-part regression model can be specified as below (O'Donnell *et al.,* 2008),

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \ldots + \varepsilon_i \qquad \varepsilon_i \sim IN(0, \sigma^2)$$

Observed OOP payments are assumed to be related to a latent value by the following,

$$Y_i = \begin{cases} Y_i, \text{ if } Y_i > 0 \\ 0, \text{ otherwise} \end{cases}$$

Where, Y_i denotes the OOP healthcare expenditure, and X_{1i} represented the participation in ESHI scheme membership (1= Insured and 0 = Uninsured), X_{2i} was the time-dummy (1= post-intervention period and 0 = pre-intervention period), and, $X_{3i,}$ $X_{4i \ldots}$ were the control variables (e.g., sex, age, marital status, educational level, job position, income, any chronic condition, inpatient care use, types of healthcare providers). The inpatient control variable was added only in the second part as all inpatient care incurred OOP healthcare expenditure and no variation with a participation decision. The β_0 was a constant and $\beta_{1,}$ $\beta_{2,}$ $\beta_{3,..}$ were the estimated coefficients as well as ε_i is the random error term of the model. OOP spending for seeking care from all providers (including untrained/informal providers) and MTP providers was predicted separately in two models using the same independent variables.

5 RESULTS

5.1 Study I

5.1.1 Out-of-pocket payments

Table 5 summarises the OOP payments of households. Approximately 75% of the respondents spent OOP payments for OPD over the past 30 days or IPD over the last 1-year time period. The mean household OOP expenses for 30 days were 1,637 BDT, when considered total sample households even the non-payers. The average of OOP payments was 2,174 BDT when included only payers.

Table 5. Distribution of out-of-pocket health expenditures (household level) for 30 days

Variable	Mean/proportion (95% CI)
Among total population	
Average OOP in BDT (Mean)	1,637.6 (1586.1-1689.2)
Average OOP as a share of total expenditure (%)	7.8% (7.7%-8.0%)
Average OOP as a share of capacity-to-pay/non-food expenditure (%)	14.3% (14.1%-14.4%)
Reported any health expenditure (%)	75.3% (74.9%-75.7%)
Conditional on making any healthcare payment	
Average OOP in BDT (Mean)	2,174.0 (2106.6-2241.5)
Average OOP as a share of total expenditure (%)	10.4% (10.3%-10.6%)
Average OOP as a share of capacity-to-pay (%)	18.9% (18.7%-19.1%)

5.1.2 Catastrophic healthcare expenditure

The incidence of CHE is presented in Table 6 for two definitions across demographic and socio-economic characteristics. Using the first definition (OOP payments more than 10% of total consumption expenditure), the incidence of CHE was 24.6%. However, using the second definition (more than 40% of non-food expenditure), it was estimated at 10.9%.

Table 6. The incidence of catastrophic health expenditure (CHE) using two threshold levels by demographic and socio-economic characteristics

Variables	CHE using 10% of total expenditure as a threshold level	CHE using 40% of total expenditure as a threshold level
	% (95% CI)	% (95% CI)
Sex of household head		
Female	26.0 (24.9-27.2)	11.7 (10.9-12.6)
Male	24.3 (23.9-24.8)	10.8 (10.5-11.1)
Education of household head		
No institutional education	24.7 (24.1-25.3)	12.1 (11.7-12.6)
Up to primary	25.5 (24.7-26.3)	11.1 (10.5-11.7)
Secondary	24.0 (23.2-24.8)	9.6 (9.1-10.2)
Higher secondary	22.4 (20.5-24.3)	8.2 (6.9-9.5)
University	22.7 (20.9-24.6)	7.3 (6.2-8.5)
Having a child member in the household (<14 years)		
No	27.6 (26.8-28.4)	13.4 (12.8-14.0)
Yes	23.4 (22.9-23.8)	9.9 (9.6-10.2)
Having an elderly member in the household (>60 years)		
No	22.3 (21.9-22.7)	9.6 (9.3-9.9)
Yes	34.7 (33.7-35.7)	16.8 (16.0-17.6)
Household size (equivalence scale)		
1-2 persons	28.4 (27.3-29.5)	15.3 (14.5-16.2)
3-4 persons	22.6 (22.1-23.2)	9.6 (9.2-10.0)
5 persons or more	26.0 (25.3-26.6)	11.0 (10.5-11.5)
At least one household member seek care for chronic illness		
No	10.1 (9.7-10.5)	4.3 (4.1-4.6)
Yes	39.7 (39.0-40.3)	17.8 (17.3-18.3)
At least one household member utilized inpatient service		
No	21.3 (20.9-21.7)	9.2 (9.0-9.5)
Yes	61.7 (60.1-63.3)	29.7 (28.2-31.1)
At least one household member utilized the public facility		
No	20.5 (20.1-20.9)	8.8 (8.5-9.1)
Yes	52.4 (51.2-53.7)	25.1 (24.0-26.2)
At least one household member utilized the private facility		
No	19.8 (19.4-20.2)	8.3 (8.1-8.6)
Yes	64.9 (63.6-66.2)	32.6 (31.3-33.9)
At least one household member utilized NGO facility		
No	23.7 (23.3-24.1)	10.5 (10.2-10.8)
Yes	51.5 (48.9-54.1)	24.3 (22.1-26.6)
At least one utilized other providers (e.g., drug seller)/ self-treatment		
No	18.0 (17.5-18.4)	8.7 (8.4-9.1)
Yes	34.9 (34.2-35.6)	14.3 (13.8-14.8)
Location		
Urban	22.1 (21.4-22.8)	8.6 (8.1-9.0)
Rural	25.6 (25.1-26.1)	11.9 (11.6-12.3)

Asset quintiles		
Poorest	25.2 (24.3-26.1)	13.4 (12.7-14.1)
2nd	25.5 (24.6-26.4)	12.2 (11.5-12.9)
3rd	25.2 (24.3-26.1)	11.0 (10.4-11.7)
4th	24.8 (23.9-25.7)	10.1 (9.5-10.7)
Richest	22.0 (21.2-22.9)	6.3 (5.8-6.8)
Total	24.6 (24.2-24.9)	10.9 (10.6-11.2)

The descriptive statistics showed for both estimations that the incidence of CHE was higher among the households with female head, smaller household (1-2 persons), presence of elderly (above 60 years), utilized of healthcare for chronic illness, used of private health facility, living in rural areas, and belonged to the poorest socio-economic group. The distribution of the sample by different demographic and socio-economic characteristics is presented in Appendix 1.

5.1.3 Determinants of catastrophic healthcare expenditure

Table 7 presents the factors associated with the incidence of CHE using the first definition (OOP payments exceeds 10% of total household consumption expenditure) in model 1, and the second definition (OOP payments exceeds 40% of subsistence expenditure) in model 2. The household head's educational level, having an elderly member in the household, household size, seeking healthcare for chronic illness, utilization of private providers, geographic location, and asset quintiles were significantly associated with the incidence of CHE. Our estimated odds ratio for educational attainment showed that a household head with university-level education was 0.770 (95% CI: 0.626; 0.948) times less likely to experience CHE (definition 2) than a household having a head with no institutional education. Similar interpretations could be made by the odds-ratio of other independent variables that explained the likelihood of CHE incidence significantly (measured using both definitions).

Table 7. Factors associated with the incidence of catastrophic health expenditure (CHE)

Variable	Description	Model 1 (Dependent= CHE using 10% of total expenditure)	Model 2 (Dependent= CHE using 40% of subsistence expenditure)
		OR (95%CI)	OR (95%CI)
Sex of household head	Male (Ref= Female)	0.95 (0.878,1.029)	1.017 (0.918,1.128)
Education of household head	Up-to primary (Ref= No institutional education)	1.028 (0.964,1.097)	0.93 (0.856,1.010)
	Secondary (Ref= No institutional education)	1.011 (0.944,1.082)	0.912* (0.833,0.997)
	Higher secondary (Ref= No institutional education)	0.983 (0.852,1.135)	0.857 (0.701,1.047)
	University (Ref= No institutional education)	0.998 (0.867,1.150)	0.770* (0.626,0.948)
Having child member in the household	Yes (Ref= No)	0.897** (0.836,0.964)	0.900* (0.820,0.988)
Having an elderly member in the household	Yes (Ref= No)	1.317*** (1.236,1.403)	1.333*** (1.232,1.442)
Household size (equivalence scale)	3-4 persons (Ref= 1-2 persons)	0.707*** (0.646,0.774)	0.621*** (0.554,0.695)
	5 persons or more (Ref= 1-2 persons)	0.586*** (0.528,0.650)	0.535*** (0.468,0.610)
At least one member seek care for chronic illness	Yes (Ref=No)	4.692*** (4.434,4.966)	3.703*** (3.419,4.010)
At least one household member utilized inpatient service	Yes (Ref=No)	1.079 (0.978,1.190)	0.96 (0.865,1.067)
At least one household member utilized the public facility	Yes (Ref=No)	4.117*** (3.807,4.452)	3.260*** (2.980,3.567)
At least one household member utilized the private facility	Yes (Ref=No)	9.880*** (9.010,10.83)	6.852*** (6.216,7.552)

At least one household member utilized NGO facility	Yes (Ref=No)	0.131*** (0.111,0.153)	0.193*** (0.163,0.229)
At least one utilized of other providers	Yes (Ref=No)	2.717*** (2.578,2.863)	1.761*** (1.646,1.884)
Location	Rural (Ref= Urban)	1.046 (0.982,1.113)	1.067 (0.981,1.159)
Administrative divisions	Chittagong (Ref=Barisal)	0.643*** (0.584,0.707)	0.530*** (0.471,0.595)
	Dhaka (Ref=Barisal)	0.467*** (0.425,0.513)	0.490*** (0.436,0.550)
	Khulna (Ref=Barisal)	0.435*** (0.395,0.479)	0.415*** (0.368,0.468)
	Rangpur (Ref=Barisal)	0.465*** (0.408,0.530)	0.517*** (0.440,0.607)
	Rajshahi (Ref=Barisal)	0.486*** (0.444,0.531)	0.444*** (0.399,0.495)
	Sylhet (Ref=Barisal)	0.410*** (0.362,0.465)	0.310*** (0.261,0.368)
Asset quintiles	2nd (Ref=Poorest)	0.974 (0.901,1.054)	0.854** (0.776,0.941)
	3rd (Ref=Poorest)	0.889** (0.820,0.963)	0.720*** (0.651,0.796)
	4th (Ref=Poorest)	0.785*** (0.722,0.854)	0.595*** (0.535,0.663)
	Richest (Ref=Poorest)	0.630*** (0.571,0.694)	0.328*** (0.287,0.376)
Constant		0.163*** (0.142,0.188)	0.108*** (0.091,0.129)
N		**45,289**	**45,289**
Log-likelihood (LR)		-19,057	-12,406
LR chi2		12,371	5,797.1
Degrees of freedom		26	26
Prob > chi-square		<0.000	<0.000
Pseudo R^2		0.245	0.189

Note: * p<0.05, ** p<0.01, *** p<0.001; Ref= Reference group

Larger households were less likely to face the CHE compared to the smaller ones in both models. At least one household member's utilization of healthcare for chronic illness increased the likelihood to experience CHE in both models (OR=4.692, 95% CI: 4.434,4.966 in model 1 and OR=3.703, 95% CI: 3.419,4.010 in model 2). Households with private facility utilization had 9.880 (95% CI: 9.010,10.83) times higher chance of facing CHE using the first definition. A similar finding (OR: 6.852;

95% CI: 6.216,7.552) was observed using the second definition (model 2). The risk of facing CHE was also varied significantly with geographic locations (administrative divisions). The residents from the Barisal division had a significantly higher risk of facing CHE than all other divisions. In terms of socio-economic status, households belonging to the highest asset quintile had significantly lower likelihoods of facing CHE compared to the lowest quintile in both models.

5.1.4 Economic impoverishment

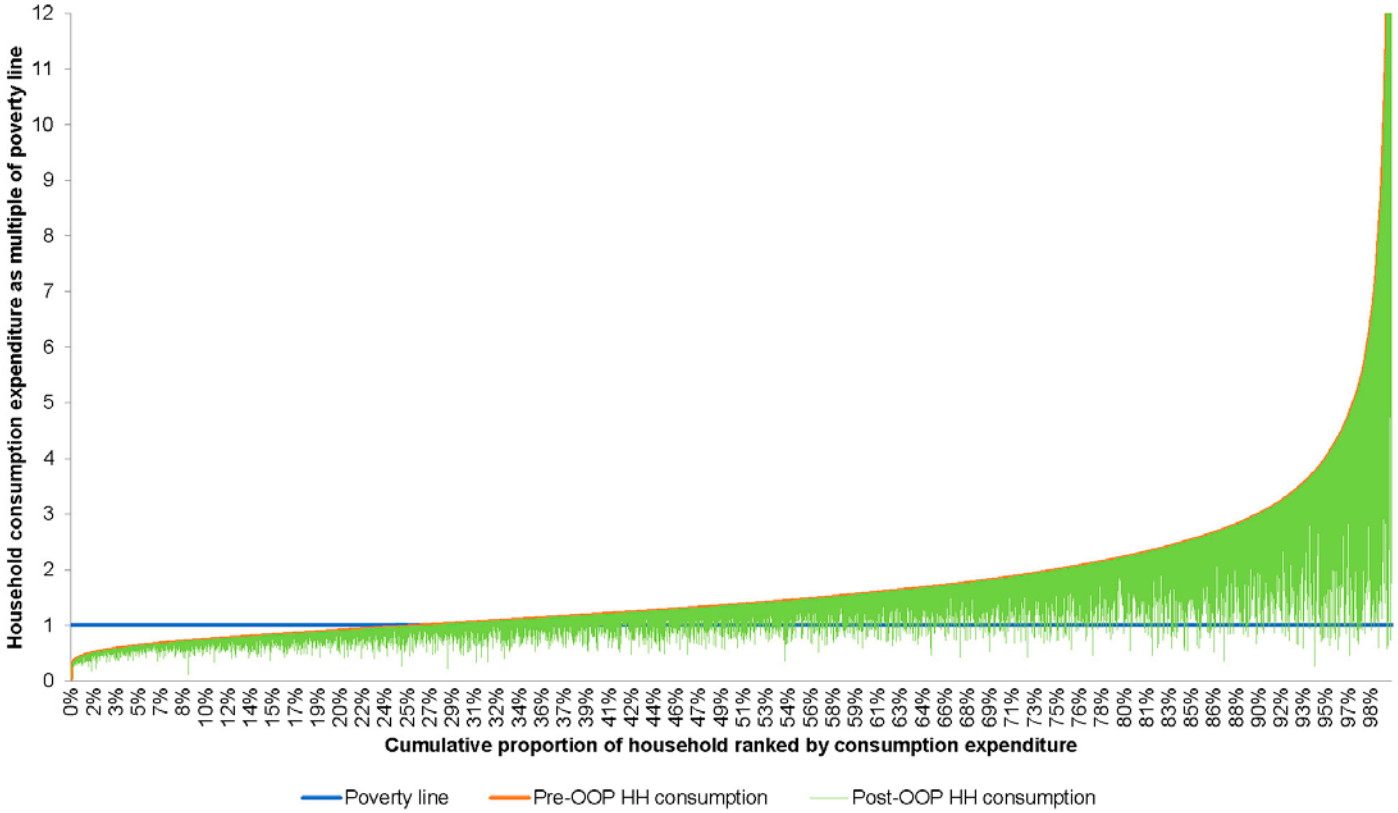
The economic impoverishment impact of OOP payments in the year 2016 is shown in Table 8. Around 5.5% of the population (or 9.0 million individuals) pushed below the national poverty line for OOP payments. Corresponding poverty impact using the international poverty line was 3.1% of the population (or 5.1 million individuals).

Table 8. Effect of out-of-pocket spending on poverty headcount over time

Poverty line	Measurement	Poverty headcount
National poverty line	% population pushed below national poverty line (95% CI)	5.5% (5.1%-5.9%)
	Number of individuals (in millions)	9.0
1.9 international dollar spending per capita per day as the poverty line	% population pushed below the international poverty line (95% CI)	3.1% (2.8%-3.4%)
	Number of individuals (in millions)	5.1

The impact of OOP payments on poverty are presented in Pen's Parade graphs (Figure 7). The graph shows the cumulative distribution of individuals ranked by household's consumption expenditure. The share of OOP payments in total consumption expenditure was presented with the drops (green vertical lines) from the pre-OOP payments consumption expenditure line.

Figure 7. Poverty impact on Pen's Parade graph- before and after out-of-pocket payments using the national poverty line



The households in the middle and lower half of the distribution fell below the poverty line due to OOP payments. The people who were already below the poverty line, their poverty condition were further deteriorated due to OOP payments.

5.1.5 Determinants of economic impoverishment

Table 9 presents the determinants of impoverishment due to OOP payments using the national (model 3) and international (model 4) poverty line. A number of impoverishment factors were identified through these models. Education of the household heads, having child members and elderly members in the household, larger household size, chronic illness, utilization of private provider and rural residence, and geographic location were significantly associated with impoverishment. The households having heads with university level education were less likely to get impoverished. Considering national poverty line, (model 3), if a household head had university-level education, the household was 0.236 times less likely (OR: 0.236, 95% CI: 0.166, 0.337) to face impoverishment and it was 0.114 times less likely (OR: 0.114 95% CI=0.0564, 0.230) to face impoverishment considering international poverty line.

Table 9. Factors associated with the impoverishment from out-of-pocket healthcare spending

Variables	Description	Model 3 (Dependent= impoverishment due to OOP payment using the national poverty line)	Model 4 (Dependent= impoverishment due to OOP payment using 1.90 Int dollar per person per day as poverty line
		OR (95%CI)	OR (95%CI)
Sex of household head	Male (Ref= Female)	1.034 (0.901,1.186)	0.885 (0.733,1.070)
Education of household head	Up-to primary (Ref= No institutional education)	0.891* (0.809,0.981)	0.702*** (0.616,0.801)
	Secondary (Ref= No institutional education)	0.608*** (0.544,0.679)	0.426*** (0.363,0.501)
	Higher secondary (Ref= No institutional education)	0.281*** (0.200,0.395)	0.148*** (0.0787,0.277)
	University (Ref= No institutional education)	0.236*** (0.166,0.337)	0.114*** (0.0564,0.230)
Having a child member in the household	Yes (Ref= No)	1.481*** (1.307,1.678)	2.095*** (1.731,2.537)
Having an elderly member in the household	Yes (Ref= No)	1.250*** (1.132,1.382)	1.184* (1.032,1.359)

Household size (equivalence scale)	3-4 persons (Ref 1-2 persons)	0.970 (0.822,1.144)	0.997 (0.774,1.283)
	5 persons or more (Ref= 1-2 persons)	1.058 (0.883,1.268)	1.314* (1.004,1.721)
At least one member seek care for chronic illness	Yes (Ref=No)	2.275*** (2.073,2.498)	2.043*** (1.803,2.315)
At least one household member utilized inpatient service	Yes (Ref=No)	0.963 (0.838,1.107)	0.811* (0.665,0.989)
At least one household member utilized the public facility	Yes (Ref=No)	2.214*** (1.981,2.475)	2.057*** (1.766,2.396)
At least one household member utilized private facility	Yes (Ref=No)	2.231*** (1.958,2.543)	1.803*** (1.492,2.179)
At least one household member utilized NGO facility	Yes (Ref=No)	0.506*** (0.409,0.625)	0.696* (0.522,0.927)
At least one household member utilized other providers	Yes (Ref=No)	1.747*** (1.608,1.897)	1.919*** (1.713,2.151)
Location	Rural (Ref= Urban)	1.469*** (1.328,1.626)	1.871*** (1.607,2.177)
Administrative divisions	Chittagong (Ref=Barisal)	0.388*** (0.331,0.453)	0.370*** (0.297,0.462)
	Dhaka (Ref=Barisal)	0.430*** (0.369,0.501)	0.369*** (0.295,0.462)
	Khulna (Ref=Barisal)	0.710*** (0.616,0.818)	0.852 (0.702,1.034)
	Rangpur (Ref=Barisal)	0.677*** (0.555,0.824)	0.957 (0.748,1.225)
	Rajshahi (Ref=Barisal)	0.749*** (0.658,0.852)	0.926 (0.778,1.103)
	Sylhet (Ref=Barisal)	0.503*** (0.414,0.610)	0.339*** (0.251,0.457)
Constant		0.023*** (0.018,0.028)	0.008*** (0.006,0.011)
N		45,968	45,968
Log-likelihood (LR)		-9,156	-5,502
LR chi2		1,900	1,308
Degrees of freedom		22	22
Prob > chi-square		<0.000	<0.000
Pseudo R^2		0.094	0.106

Note: * p<0.05, ** p<0.01, *** p<0.001; Ref= Reference group

The households with at least one member who sought care for chronic illness had 2.275 (95% CI: 2.073,2.498) times higher risk of impoverishment compared to the households without such members. Utilization of healthcare from private providers also increased the risk of the impoverishment of a household by

2.231 (95% CI: 1.958,2.543) times considering the national poverty line and by 1.803 (95% CI: 1.492,2.179) times while used international poverty line. Rural households were 1.469 (95% CI: 1.328,1.626) times more likely to be impoverished (model 3). A similar result was observed considering the international poverty line (model 4). The households in the Barisal division had a significantly higher risk of falling into impoverishment.

5.2 Study II

5.2.1 Willingness to join in community-based health insurance scheme and payment mode

Eighty-six percent of informal workers were willing to pay for CBHI, and 63.4 % of them wanted to pay on a weekly basis while the rest on a monthly basis (Table 10).

Table 10. Distribution of participant's weekly versus monthly willingness-to-pay for health insurance by location and occupational group

Characteristics	Weekly payment	Monthly payment
Locations		
Sub-district	63.6%	36.4%
District	46.8%	53.3%
Metropolitan city	78.7%	21.3%
Occupational groups		
Rickshaw-puller	78.9%	21.1%
Shop-keeper	48.4%	51.6%
Restaurant workers	60.7%	39.4%
Total	**63.4%**	**36.7%**

Across the three areas, the metropolitan city had the highest proportion of respondents (78.7%) who preferred weekly payments, while the district town location had the highest proportion (53.3%) who chose monthly payments. Many rickshaw-pullers (78.9%) preferred the weekly payment mode, whereas most shopkeepers (51.6%) chose to pay monthly.

5.2.2 Willingness-to-pay for community-based health insurance

The mean WTP elicited by the bidding process was 22.8 BDT per week (95% CI: 20.9–24.8) which was almost 20% higher than the median WTP (20.0 BDT). The median WTP was the largest in the sub-district area (27.0 BDT), preceded by the

metropolitan city (24.5 BDT) and the district town (16.6 BDT). After omitting 13 outliers, the mean WTP in Metropolitan City (22.5 BDT) was the largest, followed by sub-district (21.2 BDT) and district (16.6 BDT). Rickshaw-pullers (28.2 BDT) had the highest mean WTP, followed by restaurant workers (20.4 BDT) and shop-keepers (19.2 BDT).

Table 11. Willingness-to-pay (mean and 95% confidence intervals) per week for community-based health insurance across occupational groups and locations

Characteristics	Average WTP(BDT) (95% CI)	Average WTP excluding outliers (BDT) (95% CI)	Median WTP(BDT)	Significance test (p-value)
Locations				
Sub-district	27.0(22.5-31.6)	21.2 (18.9-23.4)	20.0	<0.000
District	16.6(14.5-18.6)	16.6 (14.5-18.6)	12.5	
Metropolitan city	24.5(21.7-27.4)	22.5 (20.5-24.5)	20.0	
Occupational groups				
Rickshaw-puller	28.2(24.7-31.7)	25.0 (22.9-27.0)	20.0	<0.000
Shop-keeper	19.2(16.1-22.4)	16.5 (14.4-18.6)	12.5	
Restaurant workers	20.4(17.0-23.8)	18.2 (16.2-20.2)	15.0	
Total	**22.8(20.9-24.8)**	**20.1 (18.9-21.3)**	**20.0**	**<0.000**

WTP was significantly different across locations and occupational groups, as observed in one-way ANOVA (Table 11).

5.2.3 Determinants of willingness-to-pay

Regression analysis (Table 12) revealed that WTP for CBHI among informal workers was significantly associated with educational level, monthly income, location, and occupation. Workers with primary education were willing to pay 26.9% less than those with less than one year of schooling. With each 1 percentage point increase in worker's monthly earnings, WTP increased by 0.196%. WTP was 1.4% and 48.7% less in the sub-district and district town respectively compared to the metropolitan city. Among occupational groups, WTP differed significantly, implying that the restaurant workers and shopkeepers were willing to pay considerably less than the rickshaw-pullers (68.5% and 38.6% less). The distribution of the sample (557 workers) by different demographic and socio-economic characteristics is presented in Appendix 4.

Table 12. Association of respondent characteristics with willingness-to-pay (natural logged) for health insurance coverage from a multivariate regression analysis

Variables	Description	Model 5. Coefficient (Std. Err.)
Age	In years	-0.002(0.005)
Sex	Female (Ref = male)	-0.15(0.193)
Marital status	Unmarried (Ref = married)	0.025(0.11)
	Others (Ref = married)	0.29(0.749)
Household size	Number of household members	0.025(0.033)
Educational level	Up to primary level (Ref = less than one year)	-0.269** (0.112)
	More than primary level (Ref = less than one year)	-0.056(0.125)
Monthly income	Logged income per month	0.196** (0.077)
Illness in the last 6 months	Illness of respondent or any household member	-0.01(0.125)
Location	Sub-district (Ref= Metropolitan city)	-0.014*** (0.102)
	District (Ref= Metropolitan city)	-0.487*** (0.105)
Occupation	Shop worker (Ref= Rickshaw-puller)	-0.685*** (0.127)
	Restaurant workers (Ref= Rickshaw-puller)	-0.386** (0.115)
Constant		1.83(0.672)
N		**326**
Adjusted R-square		0.219
F-value$_{(14,146)}$ (Prob>F)		8.01 (0.000)
Mean VIF (max)		1.51 (2.24)
BP/Cook-Weisberg test (p>ch2)		0.45 (0.503)
Ramsey RESET, F (p>F)		3.46 (0.017)

Note: *** and ** denote p< 0.01 and p<0.05 respectively; Ref= Reference group; Std. Err.= Standard error

The regression model accounts for 21.9% of all deviations of the independent variable (Adjusted R-square=0.219). We found that the model lacked heteroscedasticity by performing the test of Breusch-Pagan / Cook-Weisberg. The variance inflation factor (VIF) measure had the highest value of 2.24, which suggest that the regression model was not affected by multicollinearity problem. Sufficient evidence of missing variable bias in the model was not found using the Ramsey Regression Equation Specification Error Test (RESET). To test the robustness of the association between the amount of WTP (natural logged) and its predictors, a robust standard error was calculated (Table 11).

The GLM showed that the educational level, monthly income, location and occupation of the worker was significantly associated with the WTP as a share of income (Appendix 5). This model indicated that the higher-income households were more inclined to have a lower WTP share (as a percentage of the income).

5.3 Study III

5.3.1 Utilization of healthcare

Table 13 shows the use of healthcare services among insured and uninsured groups in the last 90-day period prior to the data collection. We found a significant difference (P= 0.013) between insured and uninsured groups in the healthcare-seeking behaviour of people suffering from illness. 97.7% of insured (815) and 99.2% of uninsured (786) sought healthcare for illness or their conditions. A relatively higher percentage of insured (50.7%) than uninsured (39.4%) sought health service from MTPs. The highest percentage of healthcare services were used from private providers in both groups (92.3% in insured and 90.7% in uninsured groups) preceded by government providers (5.9% in insured and 6.7% in uninsured groups).

Table 13. Self-reported illness and utilization of healthcare in the last 90 days

Healthcare seeking/ illness	Insured		Uninsured		
	N	% (95% CI)	N	% (95% CI)	p-value[a]
Individual-level sample (N)	2,519		2,519		
Suffered any illness or symptoms					0.210
No	1,685	66.9 (65.0-68.7)	1,727	68.6 (66.7-70.3)	
Yes	834	33.1 (31.3-35.0)	792	31.4 (29.7-33.3)	
Seek healthcare among those who suffered illness					
No	19	2.3 (1.5-3.5)	6	0.8 (0.3-1.7)	0.013
Yes	815	97.7 (96.5-98.5)	786	99.2 (98.3-99.7)	
Seek healthcare from medically trained provider among those who sought healthcare					
No	402	49.3 (45.9-52.8)	476	60.6 (57.1-63.9)	0.001
Yes	413	50.7 (47.2-54.1)	310	39.4 (36.1-42.9)	
Self-reported illness/symptoms					
Communicable diseases	106	12.7 (10.6-15.2)	118	14.9 (12.6-17.6)	0.061
Non-communicable diseases	122	14.6 (12.4-17.2)	117	14.8 (12.5-17.4)	
Accident and Injuries	21	2.5 (1.6-3.8)	28	3.5 (2.4-5.1)	
Female reproductive health problem and delivery care	25	3.0 (2.0-4.4)	14	1.8 (1.0-3.0)	
Symptoms	415	49.8 (46.4-53.2)	411	51.9 (48.4-55.4)	
Others	145	17.4 (15.0-20.1)	104	13.1 (10.9-15.7)	
Healthcare provider utilized					
Public	48	5.9 (4.5-7.7)	53	6.7 (5.2-8.7)	0.079
Private	752	92.3 (90.2-93.9)	713	90.7 (88.5-92.6)	
NGO	-	(-)	6	0.8 (0.3-1.7)	
Others (e g. traditional)	15	1.8 (1.1-3.0)	14	1.8 (1.1-3.0)	

Inpatient care utilized					
No	771	94.6 (92.8-96.0)	733	93.3 (91.3-94.8)	0.260
Yes	44	5.4 (4.0-7.2)	53	6.7 (5.2-8.7)	

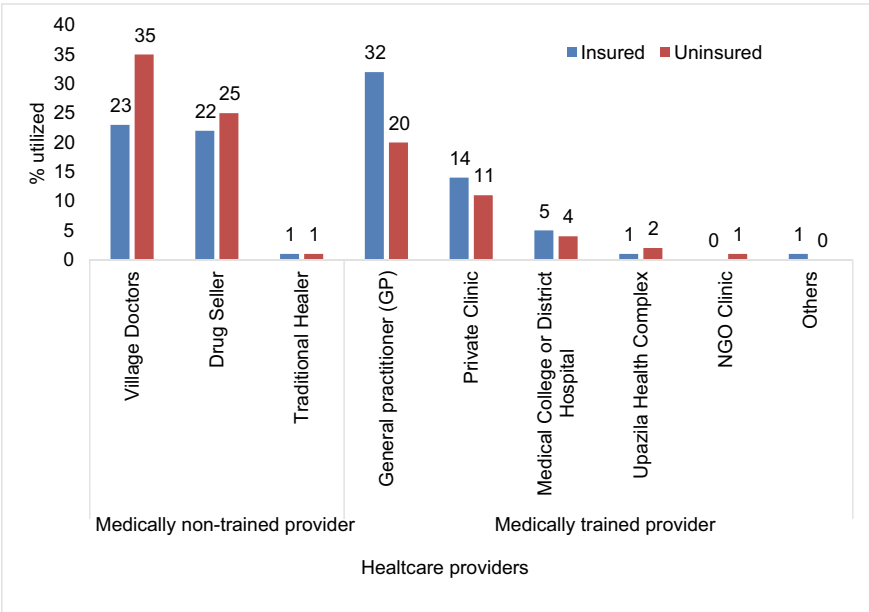
[a]Chi-square test

Insurance status (P=0.061) was not significantly related to self-reported illness or symptoms. However, though not significant, the self-reported illnesses or symptoms were differently distributed across the insured and uninsured groups.

5.3.2 Healthcare seeking behaviour

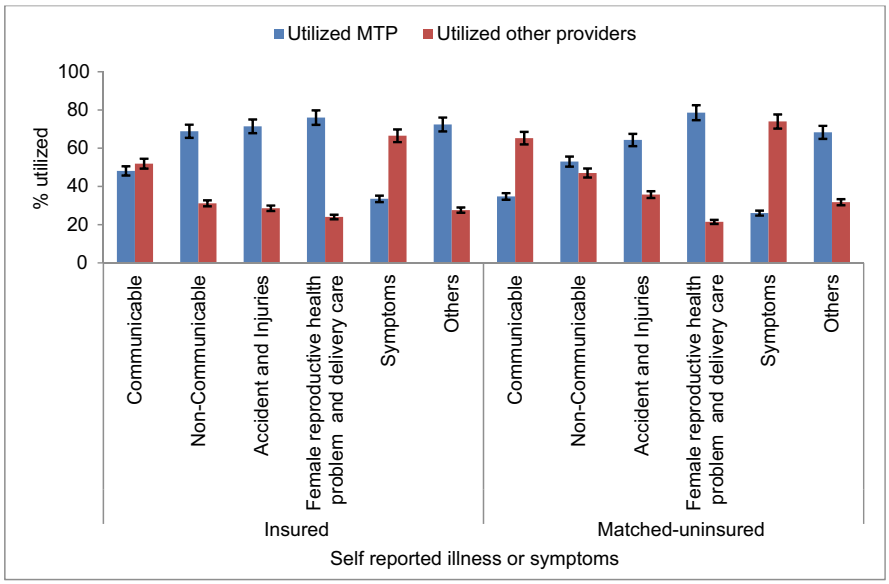
Figure 8 demonstrates the breakdown of the utilization of healthcare from different providers in insured and uninsured groups. It was noted that the insured utilized health services 12% and 3% less from the medically untrained village doctors and drug sellers than their corresponding uninsured. On the other hand, the total service utilization from medically trained MBBS / specialist doctors was 12% higher among the insured than the uninsured ones. Participants of the CBHI scheme used "private clinics" and "Medical College hospitals and district hospitals" (14% and 5% respectively) higher than the uninsured households (11% and 4% respectively).

Figure 8. Healthcare seeking behaviour of community-based health insurance scheme enrolees and uninsured group before matching



The utilizations of MTPs and other service providers for different self-reported illnesses or symptoms between insured and uninsured individuals are shown in Figure 9. The uses of MTPs were higher for non-communicable diseases, accidents and injuries, reproductive health issues for women and care for delivery, other symptoms in both insured and uninsured groups.

Figure 9. Medically trained providers utilization between insured and uninsured groups by self-reported illness or symptoms



For communicable diseases, the use of MTPs by the uninsured was significantly low. Such uses of MTPs for various symptoms (e.g., fever, weakness) were low in both insured and uninsured groups.

5.3.3 Association between community-based health insurance enrolment and medically trained healthcare provider utilization

The multilevel logistic regression analysis revealed that the insured were 2.111 fold more likely to use MTPs than uninsured (Table 14). Among the control variables, age, marital status, education, illnesses and symptoms, inpatient care utilization and asset quintiles showed significant association with MTP utilization. For instance, the use of MTPs was significantly lower among the individuals with single marital status (OR=0.371; 95% CI: 0.186-0.774) compared to the married ones.

Table 14. The estimated effect of community-based health insurance scheme enrolment on the utilization of medically trained healthcare providers

Independent variable	Description	Model 6. Dependent= Utilized medically trained provider
		OR (95% CI)
Health insurance status	Member (Ref= No membership)	2.111*** (1.448,3.079)
Age-group	Adult, 15-60 years (Ref= Child, 0-14 years)	0.907 (0.448,1.835)
	Elderly, 60+ (Ref= Child, 0-14 years)	0.301* (0.117,0.774)
Sex	Female (Ref= Male)	1.039 (0.657,1.644)
Marital status	Unmarried (Ref=Married)	0.371** (0.186,0.739)
	Others like, widowed/divorced/separated (Ref=Married)	0.674 (0.286,1.586)
Occupation	Labour (Ref= Agriculture worker)	1.827 (0.633,5.277)
	Sales worker (Ref= Agriculture worker)	1.836 (0.626,5.382)
	Service worker (Ref= Agriculture worker)	1.295 (0.412,4.071)
	Housewife (Ref= Agriculture worker)	1.337 (0.504,3.547)
	Transport worker (Ref= Agriculture worker)	1.527 (0.455,5.127)
	Small business (Ref= Agriculture worker)	2.056 (0.546,7.735)
	Not working/unemployed (Ref= Agriculture worker)	1.583 (0.572,4.385)
	Others (Ref= Agriculture worker)	0.230* (0.055,0.974)
Education level	Primary level (Ref= No institutional education)	1.069 (0.697,1.639)
	Junior level (Ref= No institutional education)	1.169 (0.689,1.983)
	Secondary level (Ref= No institutional education)	1.084 (0.555,2.118)
	Higher Secondary level (Ref= No institutional education)	0.948 (0.361,2.487)
	Tertiary level and other (Ref= No institutional education)	0.766 (0.177,3.304)
Location	Urban (Ref=Rural)	0.686 (0.456,1.031)
Illness or symptoms suffered	Non-communicable diseases (Ref=Communicable diseases)	2.823*** (1.543,5.164)
	Accident and Injuries (Ref=Communicable diseases)	3.969** (1.468,10.73)
	Female reproductive health problem and delivery care (Ref=Communicable diseases)	6.204** (1.821,21.13)
	Symptoms (Ref=Communicable diseases)	0.493** (0.305,0.796)
	Others (Ref=Communicable diseases)	6.125*** (3.236,11.60)
Inpatient care utilized	Yes (Ref=No)	8.365*** (3.659,19.13)

Household size	4-5 persons (Ref= <=3 persons)	0.877 (0.412,1.865)
	=>6 persons (Ref= <=3 persons)	1.045 (0.492,2.220)
Asset quintiles	2nd (Ref=Poorest)	1.152 (0.635,2.088)
	3rd (Ref=Poorest)	2.424** (1.351,4.351)
	4th (Ref=Poorest)	3.721*** (1.996,6.937)
	Richest (Ref=Poorest)	6.954*** (3.580,13.51)
Constant		0.252 (0.059,1.082)
N		**1,601**
LR chi2(32)		**146.9**
Prob > chi2		**0.000**

Note: * p<0.05, ** p<0.01, *** p<0.001; Ref= Reference group

The individuals were more likely to use MTPs for non-communicable condition (OR= 2.823; 95 % CI: 1.543-5.164), accidents and injuries (OR= 3.969; 95% CI: 1.568-10.73), associated complications in delivery services (OR= 6.204; 95% CI: 1.821-21.13), and for other disorders (OR= 6.125; 95% CI: 3.236-11.60) rather than communicable condition. However, such health service utilization was less probable for symptoms than communicable diseases (OR=0.493; 95% CI: 0.305-0.796). Inpatient services were more probable to be sought (OR=8.365; 95% CI: 3.659 -19.13) from the MTPs. The wealthiest household members were 6.954 times more likely than the poorest to use healthcare services from MTPs.

5.4 Study IV

5.4.1 Out-of-pocket payments in insured and uninsured groups

Table 15 provides the descriptive statistics of OOP expenses to seek healthcare from MTPs and any other providers for both insured and uninsured individuals. The OOP payments while seeking healthcare from all types of providers were smaller in the insured group (2,512 BDT) relative to the uninsured (2,660 BDT) although not statistically significant. In contrast, the average OOP spending for the services from MTPs only was significantly lower in the insured (4,189 BDT) than the uninsured ones (5,154 BDT).

Table 15. Out-of-pocket payments (BDT) for utilization of medically trained provider and all providers in the last 90 day between insured and uninsured individuals by their demographic and socio-economic characteristics

Characteristics	All providers			Medically trained providers		
	Insured	Matched-uninsured	P-value	Insured	Matched-uninsured	P-value
N	806	769		380	332	
Total OOP payment	2,512	2,660	0.313[a)]	4,189	5,154	<0.001[a)]
Age group						
Child (0-14)	1,338	1,244	<0.001[b)]	2,781	2,655	0.002[b)]
Adult (15-60)	2,846	3,252		4,435	5,723	
Elderly (60+)	3,526	2,957		4,872	6,907	
Sex				-		
Male	2,628	2,417	0.573[b)]	4,425	5,147	0.284[b)]
Female	2,416	2,851		4,017	5,159	
Marital status				-		
Married	3,177	3,472	<0.001[b)]	4,745	5,879	<0.001[b)]
Unmarried	1,374	1,348		2,700	3,057	
Others(Widowed ,Divorced and Separated)	2,818	3,225		4,510	6,897	
Household heads' occupation				-		
Agriculture worker	4,549	2,360	<0.001[b)]	8,102	4,286	<0.001[b)]
Labor	2,868	2,397		4,313	5,728	
Sales worker	1,962	3,527		2,607	4,920	
Service worker	4,075	1,390		6,771	2,562	
Housewife	2,845	3,664		4,288	5,968	
Transport worker	1,912	1,787		2,883	3,856	
Small business	2,626	6,098		3,840	9,355	
Not working or unemployed	1,980	1,819		3,605	3,849	
Others	1,770	6,705		4,105	23,267	
Household size				-		
3personsorless	2,074	2,567	0.771[b)]	3,502	4,719	0.120[b)]
4-5persons	2,496	2,931		3,662	5,795	
6personsormore	2,578	2,421		4,827	4,596	
Years of schooling group				-		
No institutional education	2,167	1,816	0.250[b)]	4,415	3,778	0.244[b)]
Primary level(years1-5)	2,623	2,635		4,284	4,917	
Junior level(years6-8)	2,765	3,172		4,412	6,278	
Secondary level(years9-10)	2,658	3,517		4,200	5,965	
Higher Secondary level(years11-12)	2,323	3,948		2,956	8,530	

Tertiary level(12+)	1,305	3,428		1,743	4,674	
Location				-		
Urban	2,805	2,707	0.674 [b)]	4,892	4,609	0.092 [b)]
Rural	2,378	2,640		3,868	5,455	
Asset quintiles				-		
Poorest	2,453	2,352	0.006 [b)]	5,240	4,899	0.267 [b)]
2nd	1,836	1,900		3,202	5,124	
3rd	2,189	2,358		3,706	4,076	
4th	2,789	2,624		4,500	4,882	
Richest	3,274	4,011		4,332	6,296	

[a)]Wilcoxon-Mann–Whitney test; [b)] Two-way ANOVA

We also observed that the OOP spending, regardless of the type of providers, differed significantly between insured and uninsured when stratified into different demographics and socio-economic attributes, namely age group, marital status, and occupation (Table 15).

5.4.2 Effect of community-based health insurance on out-of-pocket payments

Table 16 illustrates the predicted consequences of CBHI enrolment on the utilization of MTPs and all types of providers and related OOP payments when accounting for specific control variables. It was found that insured was 1.43 fold more likely to spend for utilizing health services from MTPs (95% CI=1.22-1.68) and their average OOP expenses were significantly smaller (by 6.40%) than the uninsured. In addition to CBHI status, marital status, occupation, employment and asset status significantly affected the OOP expenses for the use of MTPs. Being unmarried was negatively associated with OOP payments compared to married. However, the asset quintile, living in the urban area, types of illness, and use of inpatient services had a positive association with the OOP spending. The CBHI status did not have a strong relationship with OOP payments when we included the utilization of health services from all types of providers (including MTPs and medically non-trained providers)

Table 16. Effect of community-based health insurance scheme enrolment (individuals) on out-of-pocket (OOP) payments for seeking healthcare from medically trained providers and any providers

Variables	Description	Model 7. Dependent=OOP for utilizing medically trained providers		Model 8. Dependent=OOP for utilizing any providers	
		Stage 1. Participation (logistic model)	Stage 2. Log model of OOP spending	Stage 1. Participation (logistic model)	Stage 2. Log model of OOP spending
Health insurance status	Member (Ref=No membership)	1.429*** (1.215-1.68)	-0.064*** (-0.091–0.037)	1.076 (0.953-1.215)	-0.009 (-0.027-0.009)
Age-group	Adult,15-60years (Ref=Child,0-14years)	0.799 (0.569-1.121)	0.01 (-0.052-0.072)	0.697** (0.547-0.888)	0.006 (-0.034-0.046)
	Elderly,60+(Ref=Child,0-14years)	0.627* (0.394-0.998)	0.006 (-0.074-0.086)	0.744 (0.527-1.05)	-0.018 (-0.069-0.034)
Sex	Female (Ref=Male)	1.113 (0.87-1.422)	-0.035 (-0.079-0.01)	1.101 (0.927-1.309)	-0.009 (-0.036-0.018)
Marital status	Unmarried (Ref=Married)	0.367*** (0.267-0.504)	-0.057* (-0.112--0.002)	0.482*** (0.384-0.606)	-0.077*** (-0.115--0.039)
	Widowed / divorced (Ref=Married)	0.893 (0.571-1.398)	0.017 (-0.052-0.086)	0.918 (0.646-1.305)	-0.006 (-0.054-0.042)
Occupation	Labor (Ref=Agriculture worker)	0.66 (0.38-1.146)	-0.005 (-0.099-0.09)	0.515** (0.335-0.79)	-0.025 (-0.085-0.035)
	Sales worker (Ref=Agriculture worker)	0.853 (0.494-1.472)	-0.073 (-0.165-0.019)	0.606* (0.389-0.944)	-0.018 (-0.079-0.044)
	Service worker (Ref=Agriculture worker)	0.504* (0.283-0.895)	-0.039 (-0.138-0.06)	0.39*** (0.248-0.614)	-0.059 (-0.125-0.006)
	Housewife (Ref=Agriculture worker)	0.984 (0.588-1.648)	-0.02 (-0.109-0.069)	0.805 (0.536-1.209)	-0.018 (-0.074-0.038)
	Transport worker (Ref=Agriculture worker)	0.699 (0.377-1.296)	-0.104 (-0.21-0.003)	0.57* (0.352-0.924)	-0.074* (-0.142--0.005)
	Small business (Ref=Agriculture worker)	1.02 (0.536-1.942)	-0.051 (-0.152-0.05)	0.659 (0.387-1.123)	-0.027 (-0.1-0.046)
	Not working / unemployed (Ref=Agriculture worker)	0.828 (0.49-1.4)	-0.046 (-0.134-0.041)	0.625* (0.413-0.946)	-0.02 (-0.078-0.037)
	Others (Ref=Agriculture worker)	0.492 (0.216-1.119)	-0.03 (-0.171-0.11)	0.693 (0.39-1.232)	-0.106** (-0.184--0.028)
Household size	4-5 persons (Ref=<=3 persons)	0.837 (0.576-1.216)	-0.015 (-0.077-0.047)	0.753 (0.564-1.005)	-0.028 (-0.07-0.013)
	=>6 persons (Ref=<=3 persons)	0.962 (0.662-1.397)	-0.034 (-0.096-0.028)	0.807 (0.604-1.077)	-0.043* (-0.084--0.002)

Education	Primary level (Ref=No institutional education)	0.911 (0.726-1.143)	-0.019 (-0.057-0.02)	0.829* (0.702-0.98)	-0.009 (-0.034-0.016)
	Junior level (Ref=No institutional education)	0.822 (0.635-1.063)	0.01 (-0.035-0.054)	0.631*** (0.52-0.766)	-0.004 (-0.034-0.026)
	Secondary level (Ref=No institutional education)	0.684* (0.497-0.942)	0.013 (-0.043-0.068)	0.593*** (0.465-0.757)	0.024 (-0.015-0.064)
	Higher secondary level (Ref=No institutional education)	1.117 (0.689-1.812)	-0.013 (-0.092-0.066)	0.949 (0.651-1.384)	-0.006 (-0.063-0.051)
	Tertiary level and other (Ref=No institutional education)	0.903 (0.475-1.717)	-0.034 (-0.126-0.058)	0.789 (0.464-1.344)	-0.001 (-0.074-0.072)
Asset quintiles	2nd (Ref=Poorest)	0.863 (0.648-1.15)	0.05* (0.001-0.099)	0.909 (0.748-1.106)	-0.001 (-0.03-0.028)
	3rd (Ref=Poorest)	1.361* (1.04-1.782)	0.024 (-0.022-0.071)	0.988 (0.813-1.201)	0.013 (-0.016-0.042)
	4th (Ref=Poorest)	1.598*** (1.218-2.097)	0.046 (-0.001-0.094)	1.027 (0.839-1.256)	0.03* (0-0.06)
	Richest (Ref=Poorest)	1.647*** (1.262-2.149)	0.067** (0.022-0.113)	0.874 (0.716-1.068)	0.059*** (0.028-0.089)
Location	Urban (Ref=Rural)	1.232* (1.031-1.471)	-0.007 (-0.036-0.023)	1.431*** (1.25-1.638)	-0.006 (-0.026-0.015)
Illness or symptoms suffered	Non-communicable diseases (Ref=communicable diseases)		0.076** (0.024-0.129)		0.11*** (0.074-0.147)
	Accident and Injuries (Ref=communicable diseases)	-	0.082* (0.009-0.155)	-	0.112*** (0.054-0.17)
	Problem and delivery care (Ref=communicable diseases)	-	0.076 (-0.008-0.16)	-	0.117*** (0.049-0.185)
	Symptoms (Ref=communicable diseases)	-	0.005 (-0.042-0.051)	-	-0.016 (-0.045-0.012)
	Others (Ref=communicable diseases)	-	0.098*** (0.05-0.146)	-	0.128*** (0.093-0.163)
Inpatient care utilized	Yes (Ref=No)	-	0.138*** (0.095-0.182)	-	0.17*** (0.131-0.209)
Constant		0.215*** (0.104-0.444)	2.085*** (1.956-2.213)	1.419 (0.818-2.461)	1.954*** (1.872-2.035)
N		5,004	704	5,004	1,567
LRchi2(32)		216	-	213.17	-
Prob. >chi2		0.000	-	0.000	-
PseudoR2		0.0527	-	0.034	-
F(32,877)		-	5.14	-	14.71
Prob. > F		-	0.000	-	0.000
Adj. R-squared		-	0.197	-	0.2348

Note: Significance levels *, **, *** are p<0.05, p<0.01, and p<0.001, respectively; Ref= Reference group

We applied some other econometric approaches for verifying the findings from the two-part models. The average treatment effect (ATE) analysis showed similar results as the two-part model, indicating that OOP spending by CBHI enrolees was significantly smaller while using MTPs (Appendix 6). Furthermore, the incorporation in the assessment of PSM's inverse probability weights did not change the relationship between CBHI enrolment and OOP payments for MTPs (Appendix 7). The Tobit model also reported considerably less OOP compensation by insured against the uninsured for the use of MTPs when accounting for a variety of demographic and socio-economic characteristics (Appendix 8). It means that the results from the two-part models were verified by the various analysis methods.

5.5 Study V

5.5.1 Effect of employer-sponsored health insurance scheme on healthcare utilization

The effects of the ESHI scheme on healthcare utilization has been illustrated in Table 17. We observed a 2.1% increase in illness in the IG and a 0.8% increase in the UG workers. The DiD calculation found that the use of healthcare from MTPs (DiD=26.1; p<0.01) was increased by about 26.0% in the IG relative to the UG workers. The DiD measure of the MTPs utilization decreased to 18.4% and remained statistically significant (p<0.05) when adjusted for the control variables.

Table 17. Utilization of healthcare among insured and uninsured RMG workers during baseline and end-line survey

Characteristics	Pre-intervention				Post-intervention				DiD [a)]	DiD accounting for covariates
	Insured (IG)		Uninsured (UG)		Insured (IG)		Uninsured (UG)			
	N	% (95% CI)	N	% (95% CI)	N	% (95% CI)	N	% (95% CI)	%	%
Suffered any illness or symptoms										
No	249	51.9 (47.4-56.3)	299	62.0 (57.6-66.3)	239	49.8 (45.3-54.3)	295	61.2 (56.8-65.5)	1.3	2.5
Yes	231	48.1 (43.7-52.6)	183	38.0 (33.7-42.4)	241	50.2 (45.7-54.7)	179	38.8 (34.4-43.2)		
Seek healthcare among those who suffered illness										
No	21	9.1 (6.0-13.6)	20	10.9 (7.1-16.4)	19	7.9 (5.1-12.0)	8	4.3 (2.1-8.3)	5.4	7.4*
Yes	210	90.9 (86.4-94.0)	163	89.1 (83.6-92.9)	222	92.1 (88.0-94.9)	179	95.7 (91.7-97.9)		
Seek healthcare among the total sample										
No	270	56.3 (51.8 -60.6)	319	66.2 (61.8 -70.3)	258	53.8 (49.3 -58.2)	303	62.9 (58.4 -67.1)	-0.8	-0.2
Yes	210	43.8 (39.4 -48.2)	163	33.8 (29.7 -38.2)	222	46.3 (41.8 -50.7)	179	37.1 (32.9 -41.6)		

Seek healthcare from MTP among the ill workers										
No	159	75.7 (69.4-81.1)	80	49.1 (41.5-56.8)	124	55.9 (49.2-62.3)	99	55.3 (47.9-62.5)	26.1***	18.4**
Yes	51	24.3 (18.9-30.6)	83	50.9 (43.2-58.5)	98	44.1 (37.7-50.8)	80	44.7 (37.5-52.1)		
Self-reported illness/symptoms										
Communicable diseases	68	29.4 (23.9-35.7)	53	29.0 (22.8-36.0)	77	32.0 (26.4-38.1)	52	27.8 (21.8-34.7)	-	-
Non-communicable diseases	14	6.1 (3.6-10.0)	4	2.2 (0.8-5.7)	13	5.4 (3.2-9.1)	2	1.1 (0.3-4.2)	-	-
Accident and Injuries	2	0.9 (0.2-3.4)	2	1.1 (0.3-4.3)	2	0.8 (0.2-3.3)	2	1.1 (0.3-4.2)	-	-
Female reproductive health problem and delivery care	1	0.4 (0.1-3.0)	2	1.1 (0.3-4.3)	3	1.2 (0.4-3.8)	10	5.3 (2.9-9.7)	-	-
Symptoms of illness	130	56.3 (49.8-62.6)	100	54.6 (47.4-61.7)	131	54.4 (48.0-60.6)	103	55.1 (47.9-62.1)	-	-
Others	16	6.9 (4.3-11.0)	22	12.0 (8.0-17.6)	15	6.2 (3.8-10.1)	18	9.6 (6.1-14.8)	-	-
Healthcare provider utilized										
Public	4	1.9 (0.7-5.0)	5	3.1 (1.3-7.2)	4	1.8 (0.7-4.7)	9	5.0 (2.6-9.4)	-	-
Private	198	94.3 (90.2-96.7)	155	95.1 (90.5-97.5)	209	94.1 (90.2-96.6)	162	90.5 (85.2-94.0)	-	-
Others (e. g. traditional)	8	3.8 (1.9-7.5)	3	1.8 (0.6-5.6)	9	4.1 (2.1-7.6)	8	4.5 (2.2-8.7)	-	-
Inpatient care utilized										
No	201	95.7 (92.0-97.8)	153	93.9 (88.9-96.7)	217	97.7 (94.7-99.1)	175	97.8 (94.2-99.2)	1.9	-0.1
Yes	9	4.3 (2.2-8.0)	10	6.1 (3.3-11.1)	5	2.3 (0.9-5.3)	4	2.2 (0.8-5.8)		

[a)]DiD= Difference-in-difference; * p<0.1, ** p<0.05, *** p<0.01

The healthcare-seeking from the private providers was the largest among the three types of providers for both IG and UG workers.

5.5.2 Effect of employer-sponsored health insurance scheme on out-of-pocket healthcare payments

Table 18 presents the OOP spending of RMG workers in the IG and UG groups during the pre-and post-intervention periods. The summary statistics revealed that IG and UG spent 1,198 BDT (15.4 USD) and 818 BDT (10.5 USD) as OOP, respectively during pre-intervention for seeking healthcare from all types of providers. This was decreased in the IG to 951 BDT (12.2 USD) and raised in the UG to 1,681 BDT (21.6 USD) in the post-intervention period.

Table 18. Out-of-pocket payments (BDT) for healthcare among insured and uninsured readymade garment (RMG) workers during pre- and post-intervention periods

Items	Pre-intervention				Post-intervention				DiD[b]
	Insured (IG)		Uninsured (UG)		Insured (IG)		Uninsured (UG)		
	N	Mean (BDT) (95% CI)	N	Mean (BDT) (95% CI)	N	Mean (BDT) (95% CI)	N	Mean (BDT) (95% CI)	Mean (BDT) (P-value)
Consultation fee	48	292.2 (239.9-344.5)	38	227.5 (179.8-275.2)	41	528.8 (154.4-903.1)	30	448 (237.1-658.9)	-145.47 (0.511)
Medicine cost	204	634.5 (334.4-934.6)	129	523.3 (383.1-663.5)	156	555.8 (401.8-709.9)	155	971.6 (445.6-1497.7)	-527.0 (0.123)
Accommodation cost	3	2,033.3 (-1,281.2-5,347.8)	0	0	4	1,950.0 (-216.8-4116.8)	5	4,460.0 (-2442.3-11362.3)	-83.3 (0.983)
Diagnostic cost	13	2,111.5 (505.5-3,717.5)	17	515.3 (346.4-684.2)	15	2,216.7 (711.3-3,722.0)	22	2,261.4 (903.7-3,619.0)	-1,600.0 (0.215)
Transport cost	46	199.7 (-20.5-419.9)	36	220.0 (84.1-355.9)	38	291.11 (80.06-502.2)	52	215.7 (95.2-336.2)	95.8 (0.600)
Other cost	5	266.0 (24.9-507.1)	4	3,725.0 (-3292.3-1,0742.3)	11	339.5 (86.2-592.9)	19	678.9 (-432.9-1,790.7)	3,181.2 (0.159)
Total OOP payments for care seeking from all providers	204	1,197.7 (483.5-1,911.9)	131	817.8 (531.2-1,104.4)	165	951.3 (567.5-1,335.1)	158	1,681.1 (611.0-2,751.2)	-1,100.0 (0.132)
Total OOP payments for care-seeking from MTPs[a]	47	3,567.7 (633.9-6,501.5)	51	1,329.4 (928.9-1,729.9)	42	2,268.7 (896.1-3,641.3)	59	3,689.7 (880.7-6,498.7)	-3,700 (0.114)

[a]MTPs= medically trained providers
[b]DiD= Difference-in-difference

In conclusion, the DiD analysis revealed that there was no significant difference in OOP spending between IG and UG, irrespective of the utilization of healthcare from MTPs or all kinds of providers.

Table 19 summarises the findings from the two-part regression model. Such models (Models 10 and 11) showed that the ESHI scheme had no effect on reducing OOP spending for seeking health services from all types of providers or MTPs only.

Table 19. Two-part regression analysis of out-of-pocket healthcare expenditure (natural logged) for seeking care from all types of providers and from medically trained providers (MTPs)

Characteristics	Description	Model 9: Seek care from all provider		Model 10: Seek care from MTPs[a]	
		1st stage (Participation probit equation)	2nd stage (Expenditure log regression)	1st stage (Participation probit equation)	2nd stage (Expenditure log regression)
		Coefficient (95% CI)	Coefficient (95% CI)	Coefficient (95% CI)	Coefficient (95% CI)
Health insurance status	Insured (Ref= Matched Uninsured)	0.244*** (0.123,0.364)	-0.122 (-0.354,0.109)	-0.118 (-0.279,0.0426)	-0.143 (-.556,0.270)
Time-dummy	Post-intervention (Ref= pre-intervention)	0.0475 (-0.0850,0.180)	0.0173 (-0.238,0.273)	-0.0595 (-0.233,0.114)	0.189 (-.258,0.636)
Sex	Male (Ref= Female)	-0.262*** (-0.401,-0.123)	-0.294** (-0.569,-0.0192)	-0.376*** (-0.562,-0.191)	-0.262 (-.771,0.247)
Age	20-30 years (Ref= < 20 years)	0.222** (0.0483,0.396)	0.146 (-0.186,0.477)	0.210* (-.0310,0.452)	0.305 (-.349,0.960)
	30-40 years (Ref= < 20 years)	0.0798 (-0.145,0.304)	0.332 (-0.0971,0.761)	0.204 (-0.0954,0.503)	-0.0261 (-.811,0.759)
	40+ years (Ref= < 20 years)	0.146 (-0.147,0.438)	0.164 (-0.399,0.727)	0.103 (-0.301,0.506)	0.334 (-.775,1.443)
Marital status	Married (Ref= Unmarried)	0.0655 (-0.0962,0.227)	0.168 (-0.147,0.484)	0.203* (-.0266,0.432)	-0.223 (-.861,0.415)
	Others (Ref= Unmarried)	0.224 (-0.157,0.606)	-0.113 (-0.790,0.564)	0.347 (-0.129,0.822)	-0.953 (-.135,0.229)
Education	Secondary (Ref= Primary)	0.187** (0.0366,0.337)	0.0323 (-0.258,0.322)	0.101 (-0.1000,0.303)	-0.0412 (-.566,0.483)
	Higher secondary and above (Ref= Primary)	0.0196 (-0.305,0.344)	-0.197 (-0.871,0.477)	0.0639 (-0.358,0.486)	0.0805 (-.036,1.197)

Job position	Supervisor/ Admin level worker (Ref= Other worker)	0.0374 (-0.149,0.224)	-0.302* (-0.656,0.0528)	0.0825 (-0.160,0.325)	-0.160 (-.783,0.463)
Income	logged income per month	-0.248*** (-0.433, -.0628)	0.246 (-0.111,0.603)	0.203 (-.0422,0.448)	-0.0365 (-.742,0.669)
Chronic illness	Suffered chronic illness (Ref= Other illness)	1.657*** (1.024,2.290)	0.699** (0.127,1.272)	1.060*** (0.590,1.530)	0.540 (-.306,1.386)
Inpatient care	Sought inpatient care (Ref=Outpatient care)	-	1.717*** (1.160,2.274)	-	2.071*** (1.335,2.807)
Healthcare provider	Private (Ref=Public)	-	-1.013*** (-1.635, -0.390)	-	-
	Others (Ref=Public)	-	-0.344 (-1.172,0.484)	-	-
Constant		1.572* (-0.0488,3.192)	4.360*** (1.155,7.566)	-3.253*** (-5.408, -0.097)	7.094** (0.880,13.31)
N		**1924**	**658**	**1924**	**199**
Pseudo R-square/ Adjusted R-square		**0.070**	**0.099**	**0.07**	**0.119**

Note: * p<0.1, ** p<0.05, *** p<0.01; [a)]MTPs= medically trained providers; Ref= Reference group

However, inpatient treatment and chronic disease were positively associated with OOP spending for accessing healthcare from all types of providers. Female workers spent less as an OOP compared to male workers. The supervisor / administrative workers paid less on healthcare than other workers. The inpatient treatment was positively associated with OOP spending for MTPs utilization. The characteristics of the RMG workers in insured and uninsured groups during pre-and post-intervention periods are presented in Appendix 9.

6 DISCUSSION

The first study (Study I) provided an estimation of the impact of existing healthcare financing system on the financial risk of households in Bangladesh. Study II assessed the demand for CBHI scheme among informal workers in urban areas of Bangladesh. The Study III-V explored the possible solutions through estimating effect of health insurance scheme for mitigating challenges related to healthcare utilization from MTPs and the financial protection for accessing such care through CBHI and ESHI of households to achieve UHC.

6.1 Main findings

The incidence of CHE was calculated at 24.6% based on total consumption expenditure and 10.9% based on total non-food consumption expenditure, using two different definitions (section 4.1.1) in 2016. An earlier study of the year 2010 found the incidences of CHE at 14.2% and 9.7% respectively using the same definitions (Khan *et al.,* 2017). It implies that the healthcare financing system in Bangladesh fostered 10.4% more CHE incidences in the last six years between 2010 and 2016. The drivers of the financial protection (CHE incidence and poverty due to OOP healthcare payments) in Bangladesh could be explained by the utilization of private and public health facility, treatment for chronic condition, geographic locations reflected in the administrative divisions across the country as well the household characteristics (e.g., assets quintiles, household size, presence of children and elderly member, education level of the household head).

The investigation on the demand for CBHI, which had been recommended by the HCFS of Bangladesh to ensure financial protection of people in the informal sector of the economy, showed that a large share (86.7%) of informal workers was willing to pay. On average, the WTP was 22.8 BDT (0.286 USD) per household per week. The higher WTP was observed among rickshaw-pullers, workers with lower educational levels, higher income and those who live in a metropolitan city.

An impact assessment of a pilot CBHI scheme demonstrated that the use of MTPs among the insured informal workers was higher over the previous three months relative to the matched uninsured group. Our analysis suggested that insured individuals were 2 times more likely to use MTPs. We further observed that, relative to the uninsured, OOP payments for health services utilization from MTPs were significantly lower (by 6.4%) for insured informal workers. However, the OOP payments were not significantly different between insured and uninsured for service utilization from all types of providers.

Another health insurance scheme, sponsored by employers of the RMG workers (ESHI) demonstrated that the use of health services from the MTPs increased 18% among the insured (DiD = 18.4%, $p<0.05$). However, we observed no statistically significant impact on reducing OOP spending for health services utilization through that scheme.

6.2 Discussion of results

Study I: The high incidence of CHE in Bangladesh can be explained by the rising dependence on OOP expenditure. The Bangladesh National Health Accounts (BNHA) 2015 reported an increase in the share of OOP expenses in total health expenditure from 60% to 67% between 2010 and 2015. During this time, the share of government spending in total health spending has been decreased from 26% to 23% (MoHFW, 2018). The rise in OOP spending in Bangladesh might have an impact on the increased incidence of CHE between 2010 and 2016. However, we have observed that the data on OOP spending in HIES 2010 and 2016 were not fully comparable due to the difference in the survey tools. The BBS improved the health expenditure module of the HIES 2016 to collect more accurately OOP spending data for various healthcare services (e.g., primary healthcare, OPD, IPD and routine medication for chronic illness). In HIES 2010, questions related to OOP spending were not asked separately for these items like HIES 2016 (BBS, 2011, 2016). Therefore, caution should be taken for comparing the findings between these two years.

We found that the incidence of CHE was positively associated with having an elderly person in the household. The incidence of CHE was decreased with the increase of the household size. This might be because households with a high number of members might have a higher number of earners contributing to high total income or consumption expenditure. The households with at least one member who utilized healthcare for chronic disease were 4.7 times more likely to face CHE than households without such utilization (95% CI: 4.4,4.9). Because of chronic disease, regular treatment, and prolonged hospitalization might have caused substantial OOP expenses and enhanced the chance of facing CHE.

Because of the high cost of treatment in private hospitals, utilization of this kind of facility became associated with a high incidence of CHE. The use of public facilities has also been associated significantly with the occurrence of high CHE though at a lower magnitude than the private facility utilization. CHE for public facility utilization can be explained by the stock-out of the necessary medication and other resources (e.g., diagnosis) in this kind of facilities which made people spend as OOP to purchase additional healthcare from the private market (Mannan, 2013). However, the use of NGO services contributed to the reduction of the CHE incidences. In many cases, operations of NGO facilities are often funded by grants and donations and

such subsidy might have decreased OOP expenditure of the household (Sarwar, 2015). In addition to their micro-credit scheme in Bangladesh, several NGOs (e.g., brac, Sajeda Foundation) provide micro-insurance that offers limited risk pooling among microcredit holders (Ahsan *et al.,* 2013). NGO facilities, however, serve a smaller percentage of patients (0.61%) compared to private and public facilities in Bangladesh (BBS, 2014). Due to the dependency on donor support, the NGO facilities often suffer from sustainability risk (Sarwar, 2015). The poorest households experienced the highest percentage of CHE since this disadvantaged group had a lower capacity to spend, and any OOP expenditure constituted a high proportion of their total spending. Because of the inadequate publicly funded safety-net scheme to cope with healthcare expenses for the poor, this segment of the population was more likely to face CHE (Rahaman and Choudhury, 2012; Haider and Mahamud, 2017). This finding was supported by the observation of Selden *et al.*, 1993. Using the Grossman model, the authors showed that the poor people were more prone to uncertainty of income due to illness, which led to increase in their health spending (Selden, 1993).

The findings of this study were comparable to several previous studies in Bangladesh (Van Doorslaer *et al.,* 2007; Rahman *et al.,* 2013b; Hamid *et al.,* 2014). Rahman *et al.*, (2013) found that 9% of households faced CHE in a metropolitan city, and it was four-fold larger in the poorest households than the richest (Rahman *et al.,* 2013b). In some other Asian countries, the incidence of CHE was higher for households with an elderly member who suffered from any chronic disease (Choi *et al.,* 2015; Ghimire *et al.,* 2018). The households with a member who suffered from chronic illnesses had incurred CHE in 15 high-income countries in Europe (Arsenijevic *et al.,* 2016). Smaller households faced a higher incidence of CHE compared to the larger one (Adisa, 2015). It was observed that the incidence of CHE was higher in rural than in urban areas (Somkotra and Lagrada, 2008; Abu-Zaineh *et al.,* 2013). Though the magnitude of CHE incidences was high in the current investigation, the determinants of such incidences were generally in the same directions.

While study I investigated the condition of financial risk protection for healthcare in health system of Bangladesh, this second study reflected the potential of introducing a pre-payment scheme (health insurance) as suggested by the HCFS to secure healthcare at affordable prices particularly for informal sector workers and their dependents (MoHFW, 2012). Our study found that a high proportion of informal workers reported their WTP for CBHI. We further observed a significant positive association between monthly income and WTP for the CBHI scheme. More studies have confirmed this observation (Asenso-Okyere *et al.,* 1997; Dong *et al.,* 2003; Dror *et al.,* 2007; Ying *et al.,* 2007; Shafie and Hassali, 2013). Such observations could be explained by higher ability-to-pay of the workers due to higher earnings

(Dong *et al.,* 2003). Although we anticipated a positive association between level of education and WTP, on the contrary, it was found that education had a significantly negative impact. A previous study in urban China found similar results to ours (Ying *et al.,* 2007). In Bangladesh, understanding of health insurance was generally poor, especially among low-income people as observed in the very low share (2%) of health insurance in the total health spending (MoHFW, 2018). It was also found that WTP of the workers in the metropolitan city was significantly higher than those in district town and subdistrict area. Other studies observed a similar association between WTP and geographical locations (Asgary *et al.,* 2004; Dror *et al.,* 2007; Onwujekwe *et al.,* 2010; Binnendijk *et al.,* 2013). Rickshaw-pullers expressed higher WTP than the other occupational groups in the current study and disparity in WTP across occupational groups was observed elsewhere (Gustafsson-Wright *et al.,* 2009; Haile *et al.,* 2014; Adams *et al.,* 2015). The highest WTP of Rickshaw-puller can be understood by their income, e.g., they received cash income per working day and do not need to wait for weekly or monthly salaries unlike shopkeepers and restaurant workers.

The GLM found that WTP (as a percentage of income) was more likely to decrease with increased income. This relationship followed the laws of the Engel, specifying that the proportion of income spent on food or other necessary items declines as income increases, while actual spending increases on those items (Perthel, 1975). This result suggested that health insurance was considered as an essential good by the informal workers. This was consistent with the results of Binnendijk *et al.*, (2013), which found that the rural poor people in India regarded health insurance as a necessity (Binnendijk *et al.,* 2013). The findings of GLM could be further explained by the von Neumann- Morgenstern risk-utility theorem (Neumann and Morgenstern, 1953). Since the poor workers expect higher proportion of income-loss compared to the better-of workers due to the informal nature of employment, they reported higher WTP (premium) for CBHI as the proportion of their income.

The substantial demand for health insurance among informal workers (in study II) encourage the investigation of the effects of a CBHI scheme on their healthcare utilization from MTPs and related OOP payments. We found enrolment in the CBHI schemes contributed to increased use of MTPs and reduction of OOP payments for such use. No significant relationship between self-reported illness or symptoms and the insurance status of the individual was found in this study (Appendix 10). However, due to ex-ante moral hazard i.e. consciously taking health-risk or reduce healthy activities like exercise by the insured (Jowett *et al.,* 2004; Dave and Kaestner, 2009) and endogeneity issue, the effect of CBHI enrolment on health might not be clear. We found the utilization of MTPs significantly higher among married household members (OR=0.371; 95% CI: 0.186-0.774) than unmarried ones, which might be due to more illness in the former group. Sultana *et al.,* observed a supportive condition to our findings, meaning that the health-related quality of

life (HRQoL) was higher among unmarried (HRQoL score =0.83) than the married (HRQoL score =0.75) (Sultana *et al.,* 2016). Other studies showed that the married were more likely to report an illness than unmarried and the utilization of healthcare facility was higher among them (Joung *et al.,* 1995; Bourne, 2009). In line with Andersen healthcare utilization model, the Study II showed CBHI scheme as an enabling factor for MTP utilization (Andersen and Newman, 1973).

The lower OOP payments among insured for utilizing MTPs compared to uninsured can be explained by lower co-payment of enrollees due to their entitlement to the benefit package. On the contrary, the health services sought from non-trained providers were not covered by the benefit package of the insurances. Thus, the OOP payments for such services did not decrease. Since insurance scheme enrollees used health services from other service providers than contracted ones (by the scheme), there was no significant decrease in OOP payments for health services while considered all types of providers. However, it should be mentioned here that the quality of healthcare is important to achieving UHC through safe, effective, people-centred and timely health service delivery (WHO, 2018). Contracting MTPs for service delivery by health insurance schemes is important to ensure the quality of care, which has been emphasized in this study.

We found a significant relationship of some control variables with the predictor variables in addition to key variable of interest, i.e. insurance enrolment. Unmarried adults spent 5.7% less OOP than a married person spent on MTPs utilization. A similar relationship between marital status and OOP spending had been documented in a number of studies (Ekman, 2007; Chaudhuri and Roy, 2008; Mahumud *et al.,* 2017). Higher OOP payments among better-off informal workers (e.g., 2nd and the richest quintiles) compared to poor workers (e.g., the lowest quintile) could be explained by the ability of better-off workers to afford and use expensive private facilities which were not covered by the scheme (Khan *et al.,* 2016; Rahman *et al.,* 2017; Ahmed *et al.,* 2018b). A significant association between asset quintiles and OOP payments was found in a number of earlier studies in low- and middle-income countries (LMICs) (Rahman *et al.,* 2013b; Mahumud *et al.,* 2017; Ahmed *et al.,* 2018c). The worker, suffered from a chronic disease spent 8.2% higher OOP than a worker who suffered from a communicable disease due to high treatment costs for a chronic condition (Rahman *et al.,* 2013b).

Like the CBHI scheme, we observed higher utilization of MTPs among insured RMG workers though the OOP payments did not show any change. The non-significant effect of the ESHI scheme on reducing OOP expenditure could be explained by insured workers' health-seeking behaviour. We found that a considerable proportion of insured workers continued to use health services on their own payments from formal and informal providers (drug stores, traditional healers, etc.) out of the scheme. As a result, OOP payment remained similar among the insured RMG workers.

6.3 Discussion of methods

We used the latest survey data from HIES 2016 to estimate CHE incidences and economic impoverishment. In this round of the survey, the BBS detailed the health expenditure module, which provides a unique opportunity to more accurately estimate these. The main limitation of the study is that it is based on cross-sectional data. Ideally, longitudinal data should be used to assess the causal effect of OOP spending on economic impoverishment of households (Sauerborn *et al.,* 1996). Using cross-sectional data the point estimations could only be performed and consequently, we could not determine what proportion of households faced persistent impoverishment. It might be possible that some of the households came out of catastrophic condition or poverty in a short time.

It should be remembered here that we used the asset quintiles to classify households into different socio-economic categories. In other studies, households were placed in socio-economic groups using alternative measurements such as household consumption expenditure. In this analysis, the use of asset quintiles to divide households into socio-economic categories could be backed by the arguments from O'Donnell *et al.,* (2005). The authors observed the endogeneity problem while used both CHE estimate and total expenditure in the same econometric model (O'Donnell *et al.,* 2005). Like Joglekar, using asset quintiles for socio-economic classification we avoided the endogeneity problem in this study (Joglekar, 2008). To measure the headcount of impoverishment, we used both national and international poverty lines. We prioritized the national poverty line-based estimate for interpretation as this reflects the local context and might be more useful to policymakers. However, the findings using the international poverty line would be useful for comparing with the findings from other countries.

For estimating the WTP for CBHI among informal workers, we used the CVM method. In this method, the WTP estimate appeared to be influenced by starting bid (Kartman *et al.,* 1996; Drummond *et al.,* 2008). To address this problem, we used different starting bids (ranging from 10 BDT to 30 BDT) randomly among the participants (Drummond *et al.,* 2008). These starting bids were determined by a pilot survey in a representative workers group. One limitation of this research was that the interviews were performed between December and April and therefore could not detect seasonality in informal workers' wages. The use of multiple regression models considered workers of different income levels and could have addressed the issues of the effect of income variation on WTP. The fundamental issue in estimating WTP in the context of developing countries was that low-income people might have not understood sufficiently the health insurance scheme mechanism and benefit package (Churchill, 2006; Bawa, 2011; Panda *et al.,* 2015), which could affect the demand (WTP) for such product (Cole *et al.,* 2013). We tested a benefit package from an existing health protection scheme (Public Health Center

in Dhaka and Savar) available for the low-income people in Bangladesh. Further, the trained interviewers described the product (CBHI scheme) in an understandable way using the local language.

A weakness of the effect assessment of CBHI scheme was that since the survey took place from April to June 2014, we could not capture the seasonal variation in the use of healthcare and OOP payments. Some important variables (e.g. travel time and cost) were not considered in the regression model, which might have caused the differences in effects (MTP utilization and OOP payments) between the insured and uninsured groups. There was a possibility of recall bias, as data (e.g., health service utilization and OOP payments) was collected using a self-reported questionnaire. Earlier studies used recall periods of 1 to 12 months for collecting similar data (Ranson, 2001; Lu *et al.,* 2009; Bose and Dutta, 2015). We used a 90 day recall period to reduce the possibility of recall bias.

For assessing the effects of the ESHI scheme, it was not possible to interview the same workers in pre- and post-intervention periods because of the high dropout rate of the RMG workers. However, in the pre-and post-intervention period, the RMG workers were randomly selected from the list of employees for both IG and UG and no significant difference was found in the workers' demographic characteristics between these periods (Appendix 9). The implementation of the ESHI scheme for only one-year period might not be appropriate to evaluate the effects of such a scheme. However, applications of pre- and post-intervention design and DiD approach might have contributed positively to a better assessment of the effects, while many other studies in this research area did not consider important designing issues. For instance, some studies did not consider the pre-intervention period in the analysis (Ranson, 2002; Dror *et al.,* 2005; Gnawali *et al.,* 2009; Wagstaff *et al.,* 2009). This research, however, used a pre- and post-intervention design including intervention (insured) and comparison (uninsured) groups that provide an opportunity to obtain an estimation of DiD, which was regarded as a standard approach for assessing the effects of an intervention (Gertler *et al.,* 2011). The self-reported information about the illness, healthcare utilization, and OOP payments can be biased to some extent since the RMG workers might have poor knowledge about their medical conditions and the healthcare services (Chakraborty *et al.,* 2003; Bonfrer *et al.,* 2014). However, we used a 90-day recall period in collecting information to minimize such biases.

7 CONCLUDING REMARKS

7.1 Conclusions

Reliance on OOP payments as a mechanism for healthcare funding exposes many households to financial risk in Bangladesh. However, the informal workers who constitute the largest share of the working population in the country expressed demand for pre-payment mechanisms (health insurance) in line with the recommendations made by international development partners and the government of Bangladesh. It was further shown that the health insurance schemes led to higher utilization of healthcare services from MTPs either at a lower (for CBHI) or the same (for ESHI) amount of OOP payments. In addition to our general conclusions from these investigations, it was observed that the demographics (e.g., marital status, household size) and socio-economic (e.g., asset status, educational level, occupation) characteristics, as well as geographic locations (e.g., administrative divisions), affected the relationships with main issues of interest (CHE incidence, impoverishment, WTP, MTP utilization and OOP payments) differently. Such variation should be considered while designing a healthcare financing system for ensuring the financial protection of the people of Bangladesh or in countries with similar settings. The conclusions from this research addressed the three dimensions of UHC (population coverage, service coverage and financial risk protection), implying that more people get access to healthcare services they should get this at lower prices by joining the health insurance schemes. Additional financial resources for financing healthcare services could be generated through the premium of the informal workers and the RMG factory owners.

7.2 Policy recommendations

Bangladesh's healthcare financing should focus on finding alternatives to OOP funding to reduce the incidence of CHE and hence poverty. The study found key drivers of CHE and impoverishment, which suggests that some characteristics of the populations (married, elderly, and poor) were more prone to financial hardship and therefore, the people with such characteristics should be brought under pre-payment schemes (e.g., insurance premium or tax-funded health safety-net). Besides the public health system, benefit packages should cover chronic diseases for reducing the dependency on OOP payment for treating this and reduce related CHE. Even the prevention of such diseases would be useful for averting the incidence of CHE. The introduction of pre-payment schemes, along with strengthening the publicly funded health system, would reduce dependency on the high-cost private facilities (a strong determinant of financial hardship). Our studies observed

considerable demand for pre-payment schemes among the informal workers and therefore, such schemes can be recommended for implementation. However, cautions should be taken while implementing such schemes since the demand varied across occupations, geographic locations, educational levels and income groups so that the schemes become affordable to the target populations. Implementation of CBHI and ESHI schemes can be recommended even since such schemes have the opportunity to employ or contract MTPs from both private and public healthcare sectors to ensure access of for the informal workers and factory workers to such formal care at a lower OOP payments (co-payment), which appeared to be a challenge in LMIC settings (Sudhinaraset *et al.,* 2013). The benefit package and organizational structure of these schemes (CBHI and ESHI) should be designed carefully to cover the healthcare needs and address the health service provider choice of the beneficiaries as well as the financial sustainability so that these schemes can extend financial risk protection for healthcare access.

7.3 Future research

Only few studies in LMICs assessed the effect of health insurance schemes on increasing MTP utilization and reduction of financial risk among low-income people which have been addressed in this thesis. The demand-side of insurance schemes has been studied in this thesis at a large extent. However, further demand-side research can be conducted. For instance, non-health benefits (e.g. microcredit facility, skill training, discount shopping card, investment and savings opportunity) could be added as a parallel component of the CBHI schemes to make them attractive to the beneficiaries. Further research thus can be conducted to assess the effects of different combinations of benefits (health insurance alone and/or savings and/or micro-credit and/or subsidy on food purchase) on the enrolment and retention of the beneficiaries. Our studies mainly addressed the demand-side issues of these insurance schemes. There are large scope for conducting research in supply-side issues like, willingness of organized communities (cooperatives, trade-union, micro-credit programs, labour associations) as well as employers of large factories (RMG and other) for organizing and funding CBHI and ESHI schemes need to be studied. Since the involvement of multiple actors is essential for successful implementation of these schemes, a stakeholder analysis should be done to understand the mechanisms of engaging labour associations (or corresponding ones), owners' associations, healthcare providers, development partners, government organizations and other relevant stakeholders (e.g., buyers of RMG sector) for developing and scaling up the CBHI schemes for informal workers and ESHI schemes for formal workers.

The implementation challenges (scheme management, IT-use, interrelation among implementing actors, monitoring and evaluation, provider-payment mechanism, contracts, claim management, etc.) and their possible solutions from both demand- and supply-side need to be investigated before scaling up the schemes. We would like to propose research on evaluating the financial sustainability and feasibility of the schemes while including value-for-money approaches and qualitative investigations.

From the experience of CBHI and ESHI implementation, we found that at the initial stage these schemes required funding support for maintaining scheme activities which is difficult to cover through premium considering low number of enrolments at that period. Tax funding can be arranged to cover cost of the scheme targeting a self-financing plan until the scheme reaches the breakeven point where all costs can be covered by premium. Such initiatives should consider cost-containment and time frame for achieving financial sustainability. The contribution of taxes can even be made available while any such schemes face shortage of fund due to unforeseen events, like natural disasters, economic downturns. Further studies are required to estimate required amount of fund for initiating CBHI and ESHI schemes, possible mechanisms for leveraging the fund through tax and generating evidences about interest of government to invest in CBHI and ESHI schemes.

8 ACKNOWLEDGEMENTS

This journey has been tough, and the support of the persons (but not limited within) mentioned below has made it possible. First and foremost, I would like to thank my main supervisor, Dr. Jahangir AM Khan, for his mentorship during the entire PhD study period. He was my supervisor when I started my career as a health economics researcher at icddr,b just after completing master's degree in Health Economics from the University of Dhaka in Bangladesh. His confidence in me, encouragement and mentorship from the beginning of my career was instrumental to develop myself as a researcher and this influenced me to take this big step of being enrolled as a PhD student at Karolinska Institutet in Sweden. I would like to thank him for his investment in my development as a researcher. I have been extremely lucky to have him as a supervisor who cared so much about my work. I would like to thank my supervisor Professor Clas Rehnberg for his contribution to the project goals and manuscripts and for all the supports during the study. His support was inevitable to complete this study as he was the only supervisor who is based at Karolinska Institutet. I am indebted to Professor Rehnberg for taking care of me during travels to Stockholm for coursework, providing funding support, arranging accommodations, involving me for teaching and supervising of the students of master's degree in Health Economics, Policy and management. My special thanks go to my supervisor Professor Louis Niessen for being very positive about my work from the beginning. His confidence in me and mentorship always encouraged me to be a health economics researcher. My gratitude goes to Professor Rumana Huque of the University of Dhaka for her cordial mentorship throughout my study period and beyond.

A big thank also goes to my opponent, Dr. Kamrul Islam of Bergen University in Norway, and to the examination board members: Dr. Zarina Nahar Kabir, Dr. Birger Forsberg and Dr. Jesper Erik Sundewall. My special thanks are for Dr. Zarina Nahar Kabir, Dr. Birger Forsberg and Dr. Kamrul Islam for their valuable suggestions during the half-time control seminar, which was instrumental for the completion of my dissertation.

I would like to thank Dr. Andrew Mirelman of the World Health Organization, Mary MacLennan of London School of Economics, Dr. Veronica Vargas of Harvard University, Ewan Tomeny of Liverpool School of Tropical Medicine (LSTM) for their important feedback on my thesis.

I am indebted to Health Economics and Financing Research Group at icddr,b, where I belonged to as a researcher, for all the research opportunities and supports for my PhD study. I enjoyed the work environment and independence as a researcher there. I acknowledge the friendly and supportive attitude of Dr. Ziaul

Islam, Head of Health Economics and Financing Research Group during my entire tenure at icddr,b. I hope this research group will continue contributing to health economics research evidence and capacity building for developing the health system of Bangladesh. I would like to acknowledge the cordial support of Dr. Abdur Razzaque Saker and Dr. Marufa Sultana at several phases of my PhD research projects. I will forever remember our shared happy memories at icddr,b office and during many visits in the study sites. I am grateful to Mohammad Wahid Ahmed, Rashidul Alam Mahumud, Dr. Farzana Dorin, Sanchita Chakrovorty, Md Zahid Hasan, Naich Ahmed, Monjur Mowla and Gazi Golam Mehdi for their support in different phases of the research project and for being friendly colleagues. I am also thankful to Dr. Jasim Uddin and Haribondhu Sarma of icddr,b for guaranteeing the financial support for my PhD study and to Dr. Mahbub Elahi Chowdhury and Dr. Iqbal Anwar for involving me in different research projects, which was helpful to widen my experience and views as a health economist. I am grateful to ABM Mahabubul Alam, Senior Manager Talent Development Unit for handling my leave requests for course work and other study-related activities in the past four years. Finally, I would like to thank a countless number of data collectors, field staff, data input staff and administrators who contributed to this work. I am also grateful to icddr,b for awarding me the meritorious within-grade step increase for the exceptional performance in 2018.

I would like to acknowledge Md. Ashadul Islam, Dr. Ahmed Mustafa, Mohammad Hafizur Rahman of the Health Economics Unit of the Ministry of Health and Family Welfare for involving me in the Bangladesh National Health Accounts Team and the opportunities for associated training. I am also indebted to them for the opportunity to conduct training for the Ministry of Health personnel and for contributing to the national policy workshops. I am grateful to Dr. Valeria De Oliveira Cruz, Dr. Mohammad Touhidul Islam, and Dr. Olivia Nieveras of WHO Bangladesh country office for the opportunities to share my research findings in national and international policy forums. I am thankful to Professor Alec Morton of the University of Strathclyde Business School for giving me the opportunity to work in the project titled “Modelling resilience to health shocks in Bangladesh for optimal insurance programme design”, which was a part of my PhD training in an external university.

I have joined the African Snakebite Research Group at LSTM as a Health Economist in the last year. I am thankful to my line manager Professor Robert Harrison for his confidence in me for being successful as a research group member and for allowing time to complete my PhD dissertation. I am also grateful to Dr. Anna Trelfa, Professor Nicholas Casewell, Dr. Stuart Ainsworth, Dr. Laura-Oana Albulescu, Dr. Jaffer Al Solaiss, Charlotte Dawson, Taline Kazandjian, Dr. Stefanie Menzies, Ahmed Alatawi and other colleagues at LSTM for their supports during the last year of my PhD studentship. I am grateful to Zakir Hossain, Dr. Shajedur Rahman

Shawon, Anwarul Quadir and Abu Zafar Md Saleh Khan for providing cordial supports to my everyday life during my stay in Sweden.

I would like to thank Grand Challenge Canada (GCC) and the Swiss Agency for Development and Cooperation (SDC) for funding the pilot health insurance schemes which made this research project possible. I am also grateful to International Labor Organization and Micro-insurance Innovation Facility for funding the willingness-to-pay study. I am thankful to project partners Labor Association for Social Protection (LASP) in Chandpur and Diabetic Association Bangladesh (BADAS) for facilitating the implementation of the pilot health insurance schemes.

My deepest gratitude goes towards my loving family and friends who have all made it possible for me to complete this project and doctoral studies for the past four years. I have been delighted for my son, Nafsan, who just came this year to my family and brightened my life. His smile was enough to forget al.l the pressure of my work. Thanks to my better half, Nila, for the faith in me and for tolerating my physical absence and absent-mindedness all these years. My gratitude goes to my loving parents, Jamil and Shahanur, my elder brother, Shamim, and younger sister, Shurove, who have given me their unconditional love and support. I am also grateful to my mother-in-law, Sahida, who came to the UK from Bangladesh to support me and Nila and took care of Nafsan.

9 REFERENCES

Abu-Zaineh M, Romdhane H Ben, Ventelou B, Moatti JP, Chokri A. 2013. Appraising financial protection in health: The case of Tunisia. *International Journal of Health Care Finance and Economics* **13**: 73–93.

Adams R, Chou Y-J, Pu C. 2015. Willingness to participate and Pay for a proposed national health insurance in St. Vincent and the grenadines: a cross-sectional contingent valuation approach. *BMC Health Services Research* **15**: 148.

ADB. 2010. *The Informal Sector and Informal Employment in Bangladesh*. Manila.

Adisa O. 2015. Investigating determinants of catastrophic health spending among poorly insured elderly households in urban Nigeria. *International journal for equity in health* **14**: 79.

Aggarwal A. 2010. Impact evaluation of India's 'Yeshasvini' community-based health insurance programme. *Health economics* **19 Suppl**: 5–35.

Ahmed S, Hasan MZ, Ahmed MW, *et al.,* 2018a. Evaluating the implementation related challenges of Shasthyo Suroksha Karmasuchi (health protection scheme) of the government of Bangladesh: a study protocol. *BMC Health Services Research* **18**: 552.

Ahmed S, Hasan MZ, Laokri S, *et al.,* 2019. Technical efficiency of public district hospitals in Bangladesh: a data envelopment analysis. *Cost Effectiveness and Resource Allocation* **17**: 15.

Ahmed S, Sarker AR, Sultana M, *et al.,* 2018b. The impact of community-based health insurance on the utilization of medically trained healthcare providers among informal workers in Bangladesh Oh J (ed). *PLOS ONE* **13**: e0200265.

Ahmed S, Szabo S, Nilsen K. 2018c. Catastrophic healthcare expenditure and impoverishment in tropical deltas: evidence from the Mekong Delta region. *International journal for equity in health* **17**: 53.

Ahmed SM, Hossain MA, Chowdhury MR. 2009. Informal sector providers in Bangladesh: How equipped are they to provide rational health care? *Health Policy and Planning* **24**: 467–78.

Ahsan SM, Hamid SA, Barua S, Haider MR, Asif CA Al. 2013. Working Paper No . 17 Micro Health Insurance in Bangladesh : Innovations in Design , Delivery and Distribution Channels. No. Working Paper No. 17., Dhaka.

Akazili J. 2010. Equity in health care financing in Ghana. University of Cape Town., Cape Town.

Akhter S, Salahuddin A, Iqbal M, Malek A JN. 2010. Health and occupational safety for female workforce of garment industries in Bangladesh. *J Mech Eng* **41**: 65–70.

Alamgir H, Cooper SP, Delclos GL. 2013. Garments fire: history repeats itself. *American journal of industrial medicine* **56**: 1113–5.

Amaya Lara JL, Ruiz Gómez F. 2011. Determining factors of catastrophic health spending in Bogota, Colombia. *International journal of health care finance and economics* **11**: 83–100.

Andersen R, Newman JF. 1973. Societal and individual determinants of medical care utilisation in the United States. *The Milbank Memorial Fund Quarterly* **51**: 95–124.

Arsenijevic J, Pavlova M, Rechel B, Groot W. 2016. Catastrophic health care expenditure among older people with chronic diseases in 15 European countries. *PLoS ONE* **11**: 1–18.

Asenso-Okyere WK, Osei-Akoto I, Anum A, Appiah EN. 1997. Willingness to pay for health insurance in a developing economy. A pilot study of the informal sector of Ghana using contingent valuation. *Health Policy* **42**: 223–37.

Asgary A, Willis K, Taghvaei AA, Rafeian M. 2004. Estimating rural households' willingness to pay for health insurance. *The European journal of health economics : HEPAC : health economics in prevention and care* **5**: 209–15.

Austin PC. 2011. Optimal caliper widths for propensity-score matching when estimating differences in means and differences in proportions in observational studies. *Pharmaceutical Statistics* **10**: 150–61.

Balabanova D, Mills A, Conteh L, *et al.,* 2013. Good Health at Low Cost 25 years on: lessons for the future of health systems strengthening. *Lancet* **381**: 2118–33.

Bangladesh Bank. 2015. Annual Report 2014-2015., Dhaka.

Bawa SK. 2011. Awareness and Willingness to Pay for Health Insurance : An Empirical Study with Reference to Punjab India. *International Journal of Humanities and Social Science* **1**: 100–8.

BBS. 2011. Household Income and Expenditure Survey 2010., Dhaka.

BBS. 2014. Health and Morbidity Status Survey 2014., Dhaka.

BBS. 2016. Households Income and Expenditure Survey 2016., Dhaka.

Berki SE. 1986. A look at catastrophic medical expenses and the poor. *Health Aff (Millwood)* **5**: 138–45.

Binnendijk E, Dror DM, Gerelle E, Koren R. 2013. Estimating Willingness-to-Pay for health insurance among rural poor in India by reference to Engel's law. *Social science & medicine (1982)* **76**: 67–73.

Bonfrer I, van de Poel E, Grimm M, Van Doorslaer E. 2014. Does the distribution of healthcare utilization match needs in Africa? *Health policy and planning* **29**: 921–37.

Bose M, Dutta A. 2015. Inequity in hospitalization care: a study on utilization of healthcare services in West Bengal, India. *International journal of health policy and management* **4**: 29–38.

Bourne PA. 2009. Self-rated health and health conditions of married and unmarried men in Jamaica. *North American journal of medical sciences* **1**: 345–52.

Busse R, Chlette S. 2008. *Health Policy Developments: Focus on Prevention, Health and Aging, New Health Professions*, Busse R, Schlette S (eds). Verlag Bertelsmann Stiftung: Gütersloh.

Casagrande JT, Pike MC. 1978. An improved approximate formula for calculating sample sizes for comparing two binomial distributions. *Biometrics* **34**: 483–6.

Chakraborty N, Islam MA, Chowdhury RI, Bari W, Akhter HH. 2003. Determinants of the use of maternal health services in rural Bangladesh. *Health Promot Int* **18**: 327–37.

Chaudhuri A, Roy K. 2008. Changes in out-of-pocket payments for healthcare in Vietnam and its impact on equity in payments, 1992-2002. *Health policy (Amsterdam, Netherlands)* **88**: 38–48.

Choi JW, Choi JW, Kim JH, Yoo KB, Park EC. 2015. Association between chronic disease and catastrophic health expenditure in Korea. *BMC Health Services Research* **15**: 1–8.

Churchill C. 2006. What is insurance for the poor? In Protecting the poor, A microinsurance compendium., Geneva.

Cohen M, J Sebstad. 2006. The demand for microinsurance. In Protecting the poor, A microinsurance compendium., Geneva.

Cole S, Giné X, Tobacman J, Townsend R, Topalova P, Vickery J. 2013. Barriers to Household Risk Management: Evidence from India. *American economic journal. Applied economics* **5**: 104–35.

Cragg J. 1971. Some statistical models for limited dependent variables with application to the demand for durable goods. *Econometrica: Journal of the Econometric Society* **39**: 829–44.

Dave D, Kaestner R. 2009. Health insurance and ex ante moral hazard: Evidence from Medicare. *International Journal of Health Care Finance and Economics* **9**: 367–90.

Devadasan N, Nandraj M. 2006. Planning and implementing health insurance programme in India., Bangalore.

Dong H, Kouyate B, Cairns J, Mugisha F, Sauerborn R. 2003. Willingness-to-pay for community-based insurance in Burkina Faso. *Health economics* **12**: 849–62.

Donnell OO. 2007. Access to health care in developing countries : breaking down demand side barriers. *Cad Saude Publica.* **23**: 2820–34.

Dror DM, Radermacher R, Koren R. 2007. Willingness to pay for health insurance among rural and poor persons: field evidence from seven micro health insurance units in India. *Health policy (Amsterdam, Netherlands)* **82**: 12–27.

Dror DM, Soriano ES, Lorenzo ME, Sarol JN, Azcuna RS, Koren R. 2005. Field based evidence of enhanced healthcare utilization among persons insured by micro health insurance units in Philippines. *Health policy* **73**: 263–71.

Drummond M, O'Brien B, Stoddart G, Torrance G. 2008. *Methods for the economic evaluation of health care*. Oxford University Press: Oxford.

Ekman B. 2007. The impact of health insurance on outpatient utilization and expenditure: evidence from one middle-income country using national household survey data. *Health research policy and systems* **5**: 6.

Filmer D, Pritchett LH. 2001. Estimating wealth effects without expenditure data--or tears: an application to educational enrollments in states of India. Demography 38: 115–32.

Folland S, Goodman AC, Stano M. 2007. *The Economics of health and health care*. Pearson Prentice Hall: New Jersey.

Galama T, Galama TJ. 2011. *A Contribution to Health Capital Theory A contribution to health capital theory*. Rand Corporation: California.

Gertler PJ, Martinez S, Premand P, *et al.,* 2011. Impact Evaluation in Practice. World Bank. Washington DC.

Ghimire M, Ayer R, Kondo M. 2018. Cumulative incidence, distribution, and determinants of catastrophic health expenditure in Nepal: results from the living standards survey. *International journal for equity in health* **17**: 23.

Gnawali DP, Pokhrel S, Sié A, *et al.,* 2009. The effect of community-based health insurance on the utilization of modern health care services: evidence from Burkina Faso. *Health policy (Amsterdam, Netherlands)* **90**: 214–22.

Gould E. 2013. Employer-sponsored health insurance coverage continues to decline in a new decade. *Int J Health Serv.* **43**: 603–38.

Grossman M. 1972. On the Concept of Health Capital and the Demand for Health. *Journal of Political Economy* **80**: 223–55.

Gujarati D, Porter D. 2008. *Basic Econometrics*. McGraw-Hill/Irwin: New York City.

Gustafsson-Wright E, Asfaw A, van der Gaag J. 2009. Willingness to pay for health insurance: an analysis of the potential market for new low-cost health insurance products in Namibia. *Social science & medicine* **69**: 1351–9.

Haider MZ, Mahamud A. 2017. Beneficiary Selection and Allowance Utilization of Social Safety Net Programme in Bangladesh. *Journal of Human Rights and Social Work* **2**: 45–51.

Haile M, Ololo S, Megersa B. 2014. Willingness to join community-based health insurance among rural households of Debub Bench District, Bench Maji Zone, Southwest Ethiopia. *BMC public health* **14**: 591.

Hamid SA, Ahsan SM, Begum A. 2014. Disease-Specific Impoverishment Impact of Out-of-Pocket Payments for Health Care: Evidence from Rural Bangladesh. *Applied Health Economics and Health Policy* **12**: 421–33.

Haque M, Begum HH, Fahmida H. 2008. Supply-side effect of health care facilities on productivity amongst the female workers in the readymade garment sector. *Ibrahim Med. Coll. J.* **2**: 4–8.

Hossain MM, Hasan MT, Sultana A, Faizah F. 2019. New Mental Health Act in Bangladesh: unfinished agendas. *The Lancet Psychiatry* **6**: e1.

Hussmanns R. 1998. Developments in the design and implementation of informal sector and similar surveys - A review of national practices and experiences. In: Sixteenth International Conference of Labour Statisticians: Geneva.

IHCO. 2018. Cooperative Health Report- Assesing the worldwide contribution of cooperatives to healthcare 2018., Mexico City.

Islam MA, Akhter S, Islam M. 2018a. Health financing in Bangladesh: Why changes in public financial management rules will be important. *Health Systems and Reform* **4**: 65–8.

Islam Z, Ahmed S, Dorin FA, *et al.,* 2018b. Costs of the Bangladesh Essential Health Service Package: 2016- 2022., Dhaka.

Joarder T, Chaudhury TZ, Mannan I. 2019. Universal Health Coverage in Bangladesh: Activities, Challenges, and Suggestions. *Advances in Public Health* **2019**: 1–12.

Joglekar R. 2008. Can insurance reduce Catastrophic Out-of-pocket Health Expenditure., Mumbai.

Jones A. 1989. A double-hurdle model of cigarette consumption. *Journal of Applied Econometrics* **4**: 23–39.

Jones AM. 2000. *Health Econometrics. In Handbook of Health Economics*, Culyer A, Newhouse J (eds). Elsevier North-Holland: Amsterdam.

Joung IM a, Van Der Meer JBW, Mackenbach JP. 1995. Marital Status and Health Care Utilization. *International Journal of Epidemiology* **24**: 569–75.

Jowett M. 2004. Theoretical insights into the development of health insurance in low-income countries., Yorkshire.

Jowett M, Deolalikar A, Martinsson P. 2004. Health insurance and treatment seeking behaviour: evidence from a low-income country. *Health Economics* **13**: 845–57.

Karar ZA, Alam N, Streatfield PK. 2009. Epidemiological transition in rural Bangladesh, 1986-2006. *Global Health Action* **2**: 1–9.

Kartman B, Andersson F, Johannesson M. 1996. Willingness to pay for reductions in angina pectoris attacks. *Medical decision making : an international journal of the Society for Medical Decision Making* **16**: 248–53.

Khan J, Ahmed S. 2013. Impact of educational intervention on willingness-to-pay for health insurance: A study of informal sector workers in urban Bangladesh. *Health Economics Review* **3**: 12.

Khan J, Ahmed S, Chen T, Tomeny EM, Niessen LW. 2019. A Transparent Universal Health Coverage Index with Decomposition by Socioeconomic Groups: Application in Asian and African Settings. *Applied health economics and health policy* **17**: 399–410.

Khan J, Ahmed S, Evans TG. 2017. Catastrophic healthcare expenditure and poverty related to out-of-pocket payments for healthcare in Bangladesh-an estimation of financial risk protection of universal health coverage. *Health policy and planning* **32**: 1102–10.

Khan J, Ahmed S, MacLennan M, Sarker AR, Sultana M, Rahman H. 2016. Benefit incidence analysis of healthcare in Bangladesh - equity matters for universal health coverage. *Health policy and planning* **32**: 359–65.

Kutzin J. 1998. Health Insurance for the Formal Sector in Africa: Yes, But…. In: Beattie A, Doherty J, Gilson L, Lambo E, Shaw P (eds). *Sustainable health care financing in Southern Africa: World Bank Institute Resources*. Washington, DC, 61–73.

Leftley R, Mapfumo S. 2006. Effective microinsurance programs to reduce vulnerability., Oxford.

Lu C, Chin B, Li G, Murray CJL. 2009. Limitations of methods for measuring out-of-pocket and catastrophic private health expenditures. *Bulletin of the World Health Organization* **87**: 238–44.

Mahumud RA, Sarker AR, Sultana M, Islam Z, Khan J, Morton A. 2017. Distribution and determinants of out-of-pocket healthcare expenditures in Bangladesh. *Journal of Preventive Medicine and Public Health* **50**: 91–9.

Maligalig DS, Cuevas S, Rosario A. 2009. Informal Employment in Bangladesh., Manila.

Mamin FA, Hayes R. 2018. Physiotherapy in Bangladesh: Inequality Begets Inequality. *Frontiers in Public Health* **6**: 1–6.

Mannan M. 2013. Access to Public Health Facilities in Bangladesh: A Study on Facility Utilisation and Burden of Treatment. *Bangladesh Development Studies* **36**: 25–80.

McCord M. 2008. Visions of the future of Microinsurance, and thoughts on getting there., Washington DC.

Meyer BD, Viscusi WK, Durbin DL. 1995. Workers' compensation and injury duration: evidence from a natural experiment. *The American economic review* **85**: 322–40.

MoHFW. 2012. Expanding Social Protection for Health: Towards Universal Coverage, Health Care Financing Strategy 2012-2032., Dhaka.

MoHFW. 2015. Bangladesh National Health Accounts 1997 - 2012., Dhaka.

MoHFW. 2016. Bangladesh Essential Health Service Package (ESP)., Dhaka.

MoHFW. 2018. Bangladesh National Health Accounts (BNHA) 1997-2015., Dhaka.

Muurinen J-M. 1982. Demand for health. *Journal of Health Economics* **1**: 5–28.

Neumann J von, Morgenstern O. 1953. *Theory of Games and Economic Behavior*. Princeton University Press: New Jersey.

O'Donnell O, van Doorslaer E, Rannan-Eliya R, *et al.,* 2005. Explaining the incidence of catastrophic expenditures on health care: Comparative evidence from Asia. No. Working paper no 5., EQUITAP.

O'Donnell O, van Doorslaer E, Wagstaff A, Lindelow M. 2008. *Analyzing health equity using household survey data: A guide to techniques and their implementation*. The World Bank: Washington DC.

Okunade AA, Suraratdecha C, Benson DA. 2010. Determinants of Thailand household healthcare expenditure: the relevance of permanent resources and other correlates. *Health economics* **19**: 365–76.

Onwujekwe O, Okereke E, Onoka C, Uzochukwu B, Kirigia J, Petu A. 2010. Willingness to pay for community-based health insurance in Nigeria: Do economic status and place of residence matter? *Health Policy and Planning* **25**: 155–61.

Panda P, Chakraborty A, Dror DM. 2015. Building awareness to health insurance among the target population of community-based health insurance schemes in rural India. *Tropical medicine & international health* **20**: 1093–107.

Papke LE, Wooldridge JM. 1996. Econometric methods for fractional response variables with an application to 401(k) plan participation rates. *Journal of Applied Econometrics* **11**: 619–32.

Perthel D. 1975. Engel ' s Law Revisited. *International Statistical review* **43**: 211–8.

Pradhan M, Prescott N. 2002. Social risk management options for medical care in Indonesia. *Health economics* **11**: 431–46.

Rahaman HZ, Choudhury LA. 2012. *Social Safety Nets in Bangladesh Volume 2 Ground Realities and Policy Challenges Process Coverage Outcomes Priorities*. Dhaka.

Rahman A, Rahman M. 2013. Sickness and Treatment : A Situation Analysis among the Garments Workers. *Anwer Khan Modern Medical College Journal* **4**: 10–4.

Rahman A, Nisha MK, Begum T, Ahmed S, Alam N, Anwar I. 2017. Trends, determinants and inequities of 4+ ANC utilisation in Bangladesh. *Journal of Health, Population and Nutrition* **36**: 2.

Rahman MM, Gilmour S, Saito E, Sultana P, Shibuya K. 2013a. Self-reported illness and household strategies for coping with health-care payments in Bangladesh. *Bulletin of the World Health Organization* **91**: 449–58.

Rahman MM, Gilmour S, Saito E, Sultana P, Shibuya K. 2013b. Health-related financial catastrophe, inequality and chronic illness in Bangladesh. *PloS one* **8**: e56873.

Ranson MK. 2001. The Impact of SEWA's Medical Insurance Fund on Hospital Utilization and Expenditure., Washington, DC.

Ranson MK. 2002. Reduction of catastrophic health care expenditures by a community-based health insurance scheme in Gujarat, India: current experiences and challenges. *Bulletin of the World Health Organization* **80**: 613–21.

Rao M, Katyal A, Singh P V, *et al.,* 2014. Changes in addressing inequalities in access to hospital care in Andhra Pradesh and Maharashtra states of India: a difference-in-differences study using repeated cross-sectional surveys. *BMJ open* **4**: e004471.

Rosenbaum PR, Rubin DB. 1983. The central role of the propensity score in observational studies for causal effects. *Biometrika* **70**: 41–55.

Russell S. 2004. The economic burden of illness for households in developing countries: a review of studies focusing on malaria, tuberculosis, and human immunodeficiency virus/acquired immunodeficiency syndrome. *The American journal of tropical medicine and hygiene* **71**: 147–55.

Sarker AR, Sultana M, Mahumud RA. 2016. Cooperative societies: a sustainable platform for promoting universal health coverage in Bangladesh. *BMJ Global Health* **1**: e000052.

Sarwar MR. 2015. Bangladesh Health Service Delivery: Innovative NGO and Private Sector Partnerships. *IDS Bulletin* **46**: 17–28.

Sauerborn R, Adams A, Hien M. 1996. Household strategies to cope with the economic costs of illness. *Social science & medicine (1982)* **43**: 291–301.

Selden TM. 1993. Uncertainty and health care spending by the poor: The health capital model revisited. *Journal of Health Economics* **12**: 109–15.

Shafie AA, Hassali MA. 2013. Willingness to pay for voluntary community-based health insurance: findings from an exploratory study in the state of Penang, Malaysia. *Social science & medicine* **96**: 272–6.

Somkotra T, Lagrada LP. 2008. Payments for health care and its effect on catastrophe and impoverishment: Experience from the transition to Universal Coverage in Thailand. *Social Science and Medicine* **67**: 2027–35.

Subramanian S V., Jones K, Duncan C. 2003. Multilevel Methods for Public Health Research. In: Kawachi I, Berkman LF (eds). *Neighborhoods and Health*. Oxford University Press: Oxford.

Sudhinaraset M, Ingram M, Lofthouse HK, Montagu D. 2013. What Is the Role of Informal Healthcare Providers in Developing Countries? A Systematic Review. *PLoS ONE* **8**.

Sultana M, Sarker AR, Mahumud RA, *et al.,* 2016. Inequalities in Health Status from EQ-5D Findings: A Cross-Sectional Study in Low-Income Communities of Bangladesh. *International Journal of Health Policy and Management* **5**: 301–8.

Textiletoday. 2019. Exports earnings from the country's apparel sector have posted an 11.49% rise to $34.13 billion in the fiscal year 2018-19. *Dhaka*.

The Daily Star. 2020. The Jatiya Sangsad passes national budget FY 2018-19. *Dhaka*.

Uddin KN. 2012. Contribution of Bangladesh Diabetic Samity (BADAS) to Health Care Management. *Birdem Medical Journal* **2**: 1–2.

Uddin MJ, Koehlmoos TP, Saha NC, Khan IA, Shamsuzzaman. 2010. Child immunization coverage in rural hard-to-reach areas of Bangladesh. *Vaccine* **28**: 1221–5.

UN. 2015. Transforming our World: The 2030 Agenda for Sustainable Development., New York.

Ury HK, Fleiss JL. 1980. On approximate sample sizes for comparing two independent proportions with the use of Yates' correction. *Biometrics* **36**: 347–51.

Van Doorslaer E, O'Donnell O, Rannan-Eliya RP et al.. 2006. Effect of payments for health care on poverty estimates in 11 countries in Asia: an analysis of household survey data. *The Lancet* **368**: 1357–64

Van Doorslaer E, O'Donnell O, Rannan-Eliya RP, et al.. 2007. Catastrophic payments for health care in Asia. *Health Econ* **16**: 1159–84.

Vargas V, Begum T, Ahmed S, Smith O. 2016. Fiscal space for health in Bangladesh : towards universal health coverage., Washington DC.

Vyas S, Kumaranayake L. 2006. Constructing socio-economic status indices: how to use principal components analysis. Health policy and planning 21: 459–68.

Wagstaff A, van Doorslaer E. 2003. Catastrophe and impoverishment in paying for health care: with applications to Vietnam 1993-1998. *Health economics* **12**: 921–34.

Wagstaff A, Neelsen S. 2020. A comprehensive assessment of universal health coverage in 111 countries: a retrospective observational study. *The Lancet Global Health* **8**: e39–49.

Wagstaff A, Lindelow M, Jun G, Ling X, Juncheng Q. 2009. Extending health insurance to the rural population: An impact evaluation of China's new cooperative medical scheme. *Journal of Health Economics* **28**: 1–19.

WHO. 2010. The world health report: health systems financing: the path to universal coverage. World Health Organisation., Geneva.

WHO. 2018. Quality in universal health coverage., Geneva. Available at: https://www.who.int/servicedeliverysafety/en/. Accessed on- 12th December 2019.

Xu K, Evans DB, Kadama P, *et al.,* 2006. Understanding the impact of eliminating user fees: utilization and catastrophic health expenditures in Uganda. *Social science & medicine* **62**: 866–76.

Xu K, Evans DB, Kawabata K, Zeramdini R, Klavus J, Murray CJL. 2003. Household catastrophic health expenditure: a multicountry analysis. *Lancet* **362**: 111–7.

Ying X-H, Hu T-W, Ren J, Chen W, Xu K, Huang J-H. 2007. Demand for private health insurance in Chinese urban areas. *Health economics* **16**: 1041–50.

Zweifel P. 2007. *The Theory of Social Health the essence of knowledge The Theory of Social Health Insurance*. now Publishers Inc.: Boston.

10 APPENDIX

Appendix 1. Characteristics of the sample of Household Income Expenditure Survey 2016

Variable	Percentage (95% CI) N=45,977
Sex of household head	
Female	12.8 (12.4-13.1)
Male	87.2 (86.9-87.6)
Education of household head	
No institutional education	42.1 (41.6-42.5)
Up to primary	24.8 (24.4-25.2)
Secondary	24.8 (24.4-25.2)
Higher secondary	3.9 (3.8-4.1)
University	4.4 (4.2-4.6)
Having child member in household	
No	28.0 (27.6-28.4)
Yes	72.0 (71.6-72.4)
Having elderly member in household	
No	81.7 (81.4-82.1)
Yes	18.3 (17.9-18.6)
Household size (equivalence scale)	
1-2 persons	14.3 (14.0-14.6)
3-4 persons	52.5 (52.0-52.9)
5 persons or more	33.2 (32.8-33.7)
At least one member seek care for chronic illness	
No	51.1 (50.7-51.6)
Yes	48.9 (48.4-49.3)
At least one household member utilized inpatient service	
No	91.9 (91.7-92.2)
Yes	8.1 (7.8-8.3)
At least one household member utilized of public facility	
No	87.2 (86.9-87.5)
Yes	12.8 (12.5-13.1)
At least one household member utilized of private facility	
No	89.4 (89.1-89.7)
Yes	10.6 (10.3-10.9)

At least one household member utilized of NGO facility	
No	96.9 (96.8-97.1)
Yes	3.1 (2.9-3.2)
At least one household member utilized of other providers	
No	61.2 (60.7-61.6)
Yes	38.8 (38.4-39.3)
Location	
Urban	30.3 (29.9-30.8)
Rural	69.7 (69.2-70.1)
Asset quintiles	
Poorest	20.0 (19.6-20.3)
2nd	20.0 (19.6-20.4)
3rd	20.0 (19.6-20.4)
4th	20.0 (19.6-20.4)
Richest	20.0 (19.6-20.4)

Appendix 2. Socio-demographic characteristics of the respondents before and after propensity score matching

Characteristics	Before matching			After matching		
	Insured % (95% CI)	Uninsured % (95% CI)	p-value[a]	Insured % (95% CI)	Uninsured % (95% CI)	p-value[a]
Age group						
Child (0-14)	30.0 (28.5-31.5)	32.3 (30.6- 33.9)	0.091	29.6 (27.8- 31.4)	32.9 (31.1- 34.7)	0.039
Adult (15-60)	64.1 (62.5-65.6)	61.5 (59.8- 63.2)		64.2 (62.3- 66.0)	61.4 (59.5- 63.3)	
Elderly (60+)	5.9 (5.2- 6.7)	6.3 (5.4- 7.1)		6.3 (5.4- 7.3)	5.8 (4.9- 6.7)	
Sex						
Male	48.0 (46.4-49.6)	49.6 (47.8- 51.3)	0.204	50.4 (48.4- 52.3)	48.2 (46.3- 50.2)	0.128
Female	52.0 (50.4-53.6)	50.4 (48.7- 52.2)		49.6 (47.7- 51.6)	51.8 (49.8- 53.7)	

Marital status						
Married	50.4 (48.7-52.0)	49.4 (47.6- 51.1)		49.5 (47.6- 51.5)	48.7 (46.8- 50.7)	
Unmarried	45.4 (43.8-47.0)	47.1 (45.3- 48.8)	0.211	46.4 (44.5- 48.4)	47.8 (45.8- 49.7)	0.461
Others (Widowed, Divorced and Separated)	4.2 (3.5- 4.9)	3.6 (2.9- 4.2)		4.0 (3.3- 4.9)	3.5 (2.9- 4.3)	
Occupation						
Agriculture worker	2.8 (2.2- 3.3)	3.1 (2.5- 3.7)		2.7 (2.2- 3.5)	2.4 (1.9- 3.1)	
Labor	7.3 (6.4- 8.1)	6.1 (5.2- 6.9)		7.5 (6.6- 8.6)	6.6 (5.6- 7.6)	
Sales worker	4.4 (3.7- 5.1)	6.3 (5.5- 7.2)		5.2 (4.4- 6.2)	5.5 (4.7- 6.4)	
Service worker	5.5 (4.7- 6.2)	7.0 (6.1- 7.9)		6.6 (5.7- 7.7)	6.1 (5.2- 7.1)	
Housewife	23.4 (22.1- 24.8)	23.0 (21.6- 24.5)	0.000	22.9 (21.3- 24.6)	23.2 (21.6- 24.9)	0.742
Transport worker	3.2 (2.6- 3.7)	3.5 (2.9- 4.2)		3.5 (2.9- 4.3)	3.3 (2.7- 4.1)	
Small business	2.0 (1.5- 2.5)	2.2 (1.7- 2.7)		2.1 (1.6- 2.8)	2.2 (1.7- 2.9)	
Not working/ unemployed	48.3 (46.7-50.0)	47.6 (45.8- 49.3)		47.3 (45.4- 49.3)	49.1 (47.2- 51.1)	
Others	3.1 (2.6- 3.7)	1.3 (0.9- 1.7)		1.9 (1.5- 2.6)	1.5 (1.1- 2.1)	
Household size						
1-2 persons	3.4 (2.8- 3.9)	9.0 (8.0- 10.0)		4.7 (3.9- 5.6)	4.3 (3.6- 5.2)	
3-4 persons	34.0 (32.4- 35.5)	49.7 (47.9- 51.4)	<0.000	45.3 (43.3- 47.2)	44.5 (42.5- 46.4)	0.649
5 persons or more	62.7 (61.1- 64.2)	41.3 (39.6- 43.0)		50.1 (48.1- 52.0)	51.2 (49.3- 53.2)	

Education level						
No institutional education	20.8 (19.4-22.1)	21.3 (19.8- 22.7)		21.2 (19.6- 22.8)	21.9 (20.3- 23.5)	
Primary level (years 1-5)	38.6 (37.0-40.2)	38.9 (37.2- 40.6)		35.1 (33.3- 37.0)	37.4 (35.6- 39.3)	
Junior level (years 6-8)	23.6 (22.2-25.0)	22.3 (20.8- 23.7)		25.9 (24.2- 27.7)	22.9 (21.3- 24.6)	
Secondary level (years 9-10)	11.3 (10.3-12.4)	12.0 (10.8- 13.1)	0.09	12.5 (11.3- 13.9)	12.4 (11.2- 13.8)	0.199
Higher Secondary level (years 11-12)	4.3 (3.7- 5.0)	3.6 (2.9- 4.2)		3.6 (2.9- 4.4)	3.9 (3.2- 4.7)	
Tertiary level (12+)	1.4 (1.0- 1.7)	2.1 (1.6- 2.6)		1.7 (1.2- 2.2)	1.5 (1.1- 2.0)	
Location						
Urban	33.9 (32.3-35.4)	33.0 (31.3- 34.6)	0.43	35.1 (33.2- 36.9)	34.0 (32.2- 35.9)	0.441
Rural	66.1 (64.6-67.7)	67.0 (65.4- 68.7)		64.9 (63.1- 66.8)	66.0 (64.1- 67.8)	
Asset quintiles						
Poorest	18.0 (16.7-19.3)	21.3 (19.9- 22.8)		18.9 (17.4- 20.4)	17.9 (16.5- 19.5)	
2nd	16.2 (15.0-17.4)	22.7 (21.3- 24.2)		20.2 (18.7- 21.9)	19.7 (18.2- 21.3)	
3rd	19.6 (18.3-20.9)	19.7 (18.3- 21.1)	0.00	19.6 (18.1- 21.2)	20.9 (19.4- 22.6)	0.166
4th	24.0 (22.6-25.4)	16.9 (15.6- 18.2)		17.9 (16.5- 19.5)	19.9 (18.4- 21.5)	
Richest	22.2 (20.8-23.6)	19.4 (18.0- 20.8)		23.4 (21.8- 25.1)	21.6 (20.0- 23.2)	
N	3,548	3,146		2,519	2,519	-

[a]Chi-square test

Appendix 3. Characteristics of respondents and household before and after propensity score matching using out-of-pocket payments as outcome

Characteristics	Before matching			After matching		
	Insured	Uninsured		Insured	Uninsured	
	% (95% CI)	% (95% CI)	p-value*)	% (95% CI)	% (95% CI)	p-value*)
N	**3,548**	**3,146**		**2,502**	**2,502**	
Age group						
Child (0-14)	30.0 (28.5-31.5)	32.3 (30.6- 33.9)	0.091	29.5 (27.7 - 31.3)	32.9 (31.1 - 34.7)	0.018
Adult (15-60)	64.1 (62.5-65.6)	61.5 (59.8- 63.2)		63.6 (61.7 - 65.5)	61.4 (59.5 - 63.3)	
Elderly (60+)	5.9 (5.2- 6.7)	6.3 (5.4- 7.1)		6.8 (5.8 - 7.8)	5.7 (4.8 - 6.6)	
Sex						
Male	48.0 (46.4-49.6)	49.6 (47.8- 51.3)	0.204	50.3 (48.3 - 52.2)	48.4 (46.4 - 50.4)	0.184
Female	52.0 (50.4-53.6)	50.4 (48.7- 52.2)		49.7 (47.8 - 51.7)	51.6 (49.6 - 53.6)	
Marital status						
Married	50.4 (48.7-52.0)	49.4 (47.6- 51.1)	0.211	49.9 (47.9 - 51.8)	48.7 (46.8 - 50.7)	0.057
Unmarried	45.4 (43.8-47.0)	47.1 (45.3- 48.8)		45.6 (43.7 - 47.6)	47.9 (46.0 - 49.9)	
Others (Widowed, Divorced and Separated)	4.2 (3.5- 4.9)	3.6 (2.9- 4.2)		4.5 (3.7 - 5.3)	3.4 (2.7 - 4.1)	
Occupation						
Agriculture worker	2.8 (2.2- 3.3)	3.1 (2.5- 3.7)	0.001	2.7 (2.0 - 3.3)	2.6 (1.9 - 3.2)	0.408
Labor	7.3 (6.4- 8.1)	6.1 (5.2- 6.9)		6.4 (5.4 - 7.4)	6.5 (5.5 - 7.4)	
Sales worker	4.4 (3.7- 5.1)	6.3 (5.5- 7.2)		5.4 (4.5 - 6.2)	5.2 (4.3 - 6.1)	
Service worker	5.5 (4.7- 6.2)	7.0 (6.1- 7.9)		7.1 (6.1 - 8.1)	6.1 (5.1 - 7.0)	
Housewife	23.4 (22.1- 24.8)	23.0 (21.6- 24.5)		21.7 (20.1 - 23.4)	23.3 (21.6 - 24.9)	
Transport worker	3.2 (2.6- 3.7)	3.5 (2.9- 4.2)		4.0 (3.3 - 4.8)	3.4 (2.7 - 4.1)	
Small business	2.0 (1.5- 2.5)	2.2 (1.7- 2.7)		2.3 (1.7 - 2.9)	2.1 (1.6 - 2.7)	

Not working or unemployed	48.3 (46.7-50.0)	47.6 (45.8- 49.3)		48.2 (46.3 - 50.2)	49.4 (47.5 - 51.4)	
Others	3.1 (2.6- 3.7)	1.3 (0.9- 1.7)		2.2 (1.6 - 2.7)	1.5 (1.0 - 2.0)	
Household size						
3 persons or less	3.4 (2.8- 3.9)	9.0 (8.0- 10.0)		4.8 (3.9 - 5.6)	4.4 (3.6 - 5.2)	
4-5 persons	34.0 (32.4 - 35.5)	49.7 (47.9- 51.4)	0.001	45.8 (43.9 - 47.8)	44.4 (42.5 - 46.4)	0.410
6 persons or more	62.7 (61.1- 64.2)	41.3 (39.6- 43.0)		49.4 (47.5 - 51.4)	51.2 (49.3 - 53.2)	
Years of schooling group						
No institutional education	20.8 (19.4-22.1)	21.3 (19.8- 22.7)		21.4 (19.8 - 23.0)	21.9 (20.3 - 23.5)	
Primary level (years 1-5)	38.6 (37.0-40.2)	38.9 (37.2- 40.6)	0.090	36.1 (34.2 - 38.0)	37.6 (35.8 - 39.5)	0.632
Junior level (years 6-8)	23.6 (22.2-25.0)	22.3 (20.8- 23.7)		24.6 (22.9 - 26.3)	23.3 (21.6 - 25.0)	
Secondary level (years 9-10)	11.3 (10.3-12.4)	12.0 (10.8- 13.1)		11.9 (10.6 - 13.1)	12.0 (10.7 - 13.2)	
Higher Secondary level (years 11-12)	4.3 (3.7- 5.0)	3.6 (2.9- 4.2)		4.2 (3.4 - 4.9)	3.7 (3.0 - 4.5)	
Tertiary level (12+)	1.4 (1.0- 1.7)	2.1 (1.6- 2.6)		1.8 (1.3 - 2.4)	1.5 (1.0 - 2.0)	
Location						
Urban	33.9 (32.3-35.4)	33.0 (31.3- 34.6)	0.430	35.4 (33.5 - 37.3)	34.4 (32.6 - 36.3)	0.458
Rural	66.1 (64.6-67.7)	67.0 (65.4- 68.7)		64.6 (62.7 - 66.5)	65.6 (63.7 - 67.4)	
Asset quintiles						
Poorest	18.0 (16.7-19.3)	21.3 (19.9- 22.8)		19.2 (17.6 - 20.7)	18.3 (16.8 - 19.8)	
2nd	16.2 (15.0-17.4)	22.7 (21.3- 24.2)	0.001	20.2 (18.6 - 21.8)	19.6 (18.0 - 21.1)	0.785
3rd	19.6 (18.3-20.9)	19.7 (18.3- 21.1)		19.9 (18.3 - 21.4)	21.1 (19.5 - 22.7)	
4th	24.0 (22.6-25.4)	16.9 (15.6- 18.2)		19.1 (17.5 - 20.6)	19.5 (17.9 - 21.0)	
Richest	22.2 (20.8-23.6)	19.4 (18.0- 20.8)		21.7 (20.1 - 23.3)	21.6 (20.0 - 23.2)	

*) Chi-square test

Appendix 4. Respondent and household characteristics

Variables	Rickshaw-puller	Shop-keeper	Restaurant worker	Difference across occupational group (p-value)	Total
Age	32.9	27.3	31.1	0.028	30.4
Sex (Male %)	99.5	98.5	87.6	0.000	95.3
Marital status (Married %)	82.8	37.8	64.6	0.012	61.4
Household size	4.6	5.5	4.8	0.072	5.0
Educational level					
Less than one year (%)	72	11	44	0.092	42
Up to primary (%)	23	33	36	0.073	30
More than primary (%)	5	56	20	0.051	28
Monthly income of the worker (BDT)	7,696.5	5,870.4	5,617.0	0.011	6,399.2
Household income per equivalent adult (BDT)	3,256.6	5,015.9	3,037.9	0.004	3,839.1
Household expenditure per equivalent adult (BDT)	2,948.7	3,473.6	2,328.3	0.998	2,965.2
Location					
Metropolitan city (%)	33.3	32.1	33.7		33.0
District (%)	34.4	36.2	34.2		35.0
Sub-district (%)	32.2	31.6	32.0		31.9
Observations	**186**	**193**	**178**		**557**

Appendix 5. Association of respondent characteristics with proportion of WTP and income for health insurance coverage from a GLM regression analysis

Variables	Description	Odds ratio (95% CI)
Age	In years	0.99 (0.98-1.01)
Sex	Female (Ref = male)	0.83 (0.5-1.37)
Marital status	Unmarried (ref = married)	1.08 (0.83-1.39)
	Others (ref = married)	1.25 (0.65-2.42)
Household size	Number of household members	0.99 (0.96-1.04)
Educational level	Up to primary level (ref = less than one year)	0.66*** (0.52-0.85)
	More than primary level (ref = less than one year)	0.98 (0.71-1.37)
Monthly income	Logged income per month	0.46*** (0.34-0.61)
Illness in last 6 months	Illness of respondent or any household member	1.07 (0.71-1.61)
Location	Sub-district (ref= Metropolitan city)	1.25 (0.94-1.65)
	District (ref= Metropolitan city)	0.59*** (0.48-0.73)
Occupation	Shop worker (ref= Rickshaw-puller)	0.64** (0.45-0.9)
	Restaurant workers (ref= Rickshaw-puller)	0.75 (0.49-1.17)
Constant		25.25*** (2.28-279.84)
N		**326**

Note: ***and ** denote $p<0.01$ and $p<0.05$ respectively

Appendix 6. Propensity score matching results on average insurance effect (ATE) on OOP payment for seeking healthcare

Outcome variables	Observed coefficient (ATE)	Robust standard error	p-value
OOP payment for seeking care from any provider	-311.9	218.9	0.154
OOP payment for seeking care from a medically trained provider	-1271.3	679.8	0.061

Appendix 7. Inverse probability weighting results on average insurance effect (ATE) on OOP payment for seeking healthcare

Outcome variables	Estimation type	N	Observed coefficient	Robust standard error	p-value
OOP payment for seeking care from any provider	ATE	2,094	-353.6	252.2	0.161
	POmean	2,094	2,690.6	215.8	0.000
OOP payment for seeking care from medically trained provider	ATE	912	-1,210.3	555.7	0.029
	POmean	912	5,305.5	467.6	0.000

Appendix 8. Estimated effect of CBHI scheme enrolment (individuals) on OOP payments (natural logged) using Tobit model for seeking healthcare from medically trained providers and from any healthcare providers

Variables	Description	Dependent=OOP for utilizing medically trained providers	Dependent=OOP for utilizing any providers
		Coefficient (95% CI)	Coefficient (95% CI)
Health insurance status	Member (Ref=No membership)	-0.408*** (-0.593,-0.223)	-0.053 (-0.174,0.068)
Age-group	Adult,15-60years (Ref=Child,0-14years)	0.154 (-0.269,0.578)	0.039 (-0.223,0.302)
	Elderly,60+ (Ref=Child,0-14years)	0.102 (-0.444,0.649)	-0.119 (-0.463,0.226)
Sex	Female (Ref=Male)	-0.181 (-0.486,0.123)	-0.073 (-0.252,0.106)
Marital status	Unmarried (Ref=Married)	-0.411** (-0.788,-0.0342)	-0.505*** (-0.756,-0.255)
	Widowed/divorced (Ref=Married)	0.064 (-0.408,0.536)	-0.022 (-0.340,0.296)
Occupation	Labor (Ref=Agriculture worker)	-0.028 (-0.674,0.618)	-0.155 (-0.554,0.243)
	Sales worker (Ref=Agriculture worker)	-0.530* (-1.158,0.099)	-0.132 (-0.542,0.277)
	Service worker (Ref=Agriculture worker)	-0.242 (-0.919,0.434)	-0.363 (-0.797,0.071)
	Housewife (Ref=Agriculture worker)	-0.195 (-0.802,0.413)	-0.114 (-0.485,0.257)

	Transport worker (Ref=Agriculture worker)	-0.776** (-1.504,-0.048)	-0.527** (-0.983,-0.071)
	Small business (Ref=Agriculture worker)	-0.380 (-1.069,0.310)	-0.197 (-0.679,0.286)
	Not working/unemployed (Ref=Agriculture worker)	-0.359 (-0.958,0.239)	-0.185 (-0.564,0.193)
	Others (Ref=Agriculture worker)	-0.144 (-1.103,0.815)	-0.706*** (-1.224,-0.187)
Household size	4-5 persons (Ref=<=3 persons)	-0.069 (-0.492,0.352)	-0.085 (-0.360,0.190)
	=>6 persons (Ref=<=3 persons)	-0.226 (-0.649,0.198)	-0.193 (-0.466,0.080)
Education	Primary level (Ref=No institutional education)	-0.139 (-0.404,0.126)	-0.054 (-0.220,0.112)
	Junior level (Ref=No institutional education)	0.064 (-0.240,0.368)	-0.032 (-0.233,0.169)
	Secondary level (Ref=No institutional education)	0.035 (-0.345,0.415)	0.146 (-0.115,0.407)
	Higher secondary level (Ref=No institutional education)	-0.142 (-0.681,0.397)	-0.048 (-0.426,0.331)
	Tertiary level and other (Ref=No institutional education)	-0.323 (-0.953,0.306)	-0.069 (-0.551,0.414)
Asset quintiles	2nd (Ref=Poorest)	0.378** (0.0433,0.712)	0.0115 (-0.182,0.205)
	3rd (Ref=Poorest)	0.233 (-0.0823,0.548)	0.128 (-0.064,0.321)
	4th (Ref=Poorest)	0.373** (0.0504,0.695)	0.209** (0.010,0.408)
	Richest (Ref=Poorest)	0.541*** (0.230,0.852)	0.453*** (0.252,0.653)
Location	Urban (Ref=Rural)	-0.031 (-0.233,0.171)	-0.045 (-0.182,0.091)
Illness or symptoms suffered	Non-communicable diseases (Ref=communicable diseases)	0.556*** (0.198,0.914)	0.788*** (0.549,1.026)
	Accident and Injuries (Ref=communicable diseases)	0.469* (-0.0266,0.964)	0.721*** (0.338,1.105)
	Problem and delivery care (Ref=communicable diseases)	0.488* (-0.0852,1.061)	0.801*** (0.349,1.253)
	Symptoms (Ref=communicable diseases)	0.0472 (-0.271,0.365)	-0.0760 (-0.264,0.112)
	Others (Ref=communicable diseases)	0.722*** (0.395,1.049)	0.921*** (0.692,1.151)
Inpatient care utilized	Yes(Ref=No)	1.136*** (0.837,1.436)	1.328*** (1.068,1.587)
Constant		7.865*** (6.988,8.743)	7.048*** (6.509,7.586)
N		**706**	**1,570**
LRchi2(32)		174.7	464.2
Prob. >chi2		0.000	0.000
PseudoR2		0.070	0.084

Appendix 9. Characteristics of the Ready-Made Garments worker

Characteristics	Pre-intervention		Post-intervention	
	Insured (IG)	Uninsured (UG)	Insured (IG)	Uninsured (UG)
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Age group				
< 20 years	23.1 (19.3 - 26.9)	21.8 (18.1 -25.5)	11.3 (8.4 - 14.1)	18.8 (15.3 -22.3)
20-30 years	49.2 (44.7 - 53.6)	62.2 (57.9 -66.6)	54.1 (49.6 -58.5)	58.0 (53.6 - 62.5)
30-40 years	18.5 (15.1 - 22.0)	12.0 (9.1 - 14.9)	26.5 (22.6 - 0.5)	18.2 (14.7 - 1.6)
40+ years	9.2 (6.6 - 11.8)	3.9 (2.2 - 5.7)	8.1 (5.7 - 10.6)	5.0 (3.1 - 7.0)
Sex				
Male	40.6 (36.2 - 45.0)	52.5 (48.0 - 57.0)	31.3 (27.2 - 35.5)	47.8 (43.3 -52.3)
Female	59.4 (55.0 - 63.8)	47.5 (43.0 - 52.0)	68.7 (64.5 - 72.8)	52.2 (47.7 -56.7)
Marital status				
Married	69.0 (64.8 - 73.1)	73.2 (69.3 - 77.2)	78.5 (74.8 - 82.2)	75.4 (71.5 - 79.2)
Unmarried	27.1 (23.1 - 31.1)	24.5 (20.6 - 28.3)	18.4 (14.9 - 21.8)	22.8 (19.0 - 26.5)
Others (Widowed, Divorced and Separated)	4.0(2.2 - 5.7)	2.3 (0.9 - 3.6)	3.1 (1.6 - 4.7)	1.9 (0.7 - 3.1)
Job position				
Worker	87.7 (84.8 - 90.6)	85.1 (81.9 - 88.2)	78.7 (75.0 - 82.4)	83.1 (79.7 - 86.5)
Supervisor/admin levelworker	12.3 (9.4 - 15.2)	14.9 (11.8 - 18.1)	21.3 (17.6 - 25.0)	16.9 (13.5 - 20.3)
Household size				
3 persons or less	69.8 (65.7 - 73.9)	75.5 (71.7 - 79.4)	70.6 (66.5 - 74.6)	76.0 (72.2 - 79.8)
4-5 persons	25.4 (21.5 - 29.3)	22.2 (18.5 - 25.9)	22.3 (18.6 - 26.1)	20.0 (16.5 - 23.6)
6 persons or more	4.8 (2.9 - 6.7)	2.3 (0.9 - 3.6)	7.1 (4.8 - 9.4)	4.0 (2.2 - 5.7)
Level of education				
Primary level (years 1-5)	67.5 (63.3 - 71.7)	62.9 (58.5 - 67.2)	59.7 (55.3 -64.1)	62.4 (58.1 - 66.8)
Secondary level (years 9-10)	28.3 (24.3 - 32.4)	33.6 (29.4 - 37.8)	34.9 (30.6 - 39.1)	33.6 (29.4 - 37.8)
Higher Secondary level and above (years 11+)	4.2 (2.4 - 6.0)	3.5 (1.9 - 5.2)	5.4 (3.4 - 7.5)	4.0 (2.2 - 5.7)
Mean income per-month	7,945 (7,606 – 8,284)	9,140 (8,737 – 9,542)	12,945 (12,310 – 13,580)	11,298 (10,884 – 11,711)

Appendix 10. Association between self-reported illness or symptoms and individuals' health insurance status

Characteristics	Description	Dependent variable = Self-reported illness or symptoms (1= reported any illness or symptoms, 0= reported none)
Health insurance status	Member (Ref= No membership)	1.109(0.982,1.252)
Age-group	Adult, 15-60 years (Ref= Child, 0-14 years)	0.700**(0.550,0.891)
	Elderly, 60+ (Ref= Child, 0-14 years)	0.739(0.524,1.042)
Sex	Female (Ref= Male)	1.111(0.935,1.320)
Marital status	Unmarried (Ref=Married)	0.475***(0.378,0.597)
	Widowed/divorced (Ref=Married)	0.884(0.622,1.258)
Occupation	Labor (Ref= Agriculture worker)	0.523**(0.341,0.802)
	Sales worker (Ref= Agriculture worker)	0.627*(0.403,0.977)
	Service worker (Ref= Agriculture worker)	0.397***(0.252,0.625)
	Housewife (Ref= Agriculture worker)	0.824(0.548,1.238)
	Transport worker (Ref= Agriculture worker)	0.625(0.387,1.010)
	Small business (Ref= Agriculture worker)	0.663(0.389,1.130)
	Not working/unemployed (Ref= Agriculture worker)	0.646*(0.427,0.978)
	Others (Ref= Agriculture worker)	0.739(0.417,1.309)
Education	Primary level (Ref= No institutional education)	0.817*(0.692,0.966)
	Junior level (Ref= No institutional education)	0.627***(0.516,0.761)
	Secondary level (Ref= No institutional education)	0.577***(0.453,0.737)
	Higher Secondary level (Ref= No institutional education)	0.922(0.633,1.344)
	Tertiary level and other (Ref= No institutional education)	0.769(0.452,1.310)
Income quintiles	2nd (Ref=Poorest)	0.914(0.753,1.111)
	3rd (Ref=Poorest)	0.963(0.793,1.170)
	4th (Ref=Poorest)	1.007(0.824,1.231)
	Richest (Ref=Poorest)	0.857(0.702,1.046)
Household size	4-5 persons (Ref= <=3 persons)	0.756(0.566,1.009)
	=>6 persons (Ref= <=3 persons)	0.809(0.606,1.080)
Location	Urban (Ref=Rural)	1.474***(1.288,1.687)
Constant		1.375(0.793,2.383)
N		**5,038**
LR chi2(32)		**241.5**
Prob > chi2		**0.000**